

# SCO UNIX<sup>®</sup> System V/386 Operating System

## Release Notes

Release 3.2.0

### START HERE

1. Assemble your documentation by inserting the tab pages in the places marked with the black-edged pages. Place these *Release Notes* in the binder marked *System Administrator's Reference*.
2. Read the "Installation Notes" in these *Release Notes* to learn of any recent changes to the installation process.
3. Look over the "Compatible Hardware" section in these *Release Notes* to see if your hardware requires special consideration during installation.
4. Glance through Chapter 2, "Installation Procedure," in the *Installation Guide*. Use this chapter to help you install your UNIX system.
5. Replace the **ps(C)** manual page in the *User's Reference* with the manual page in Appendix B of these notes.

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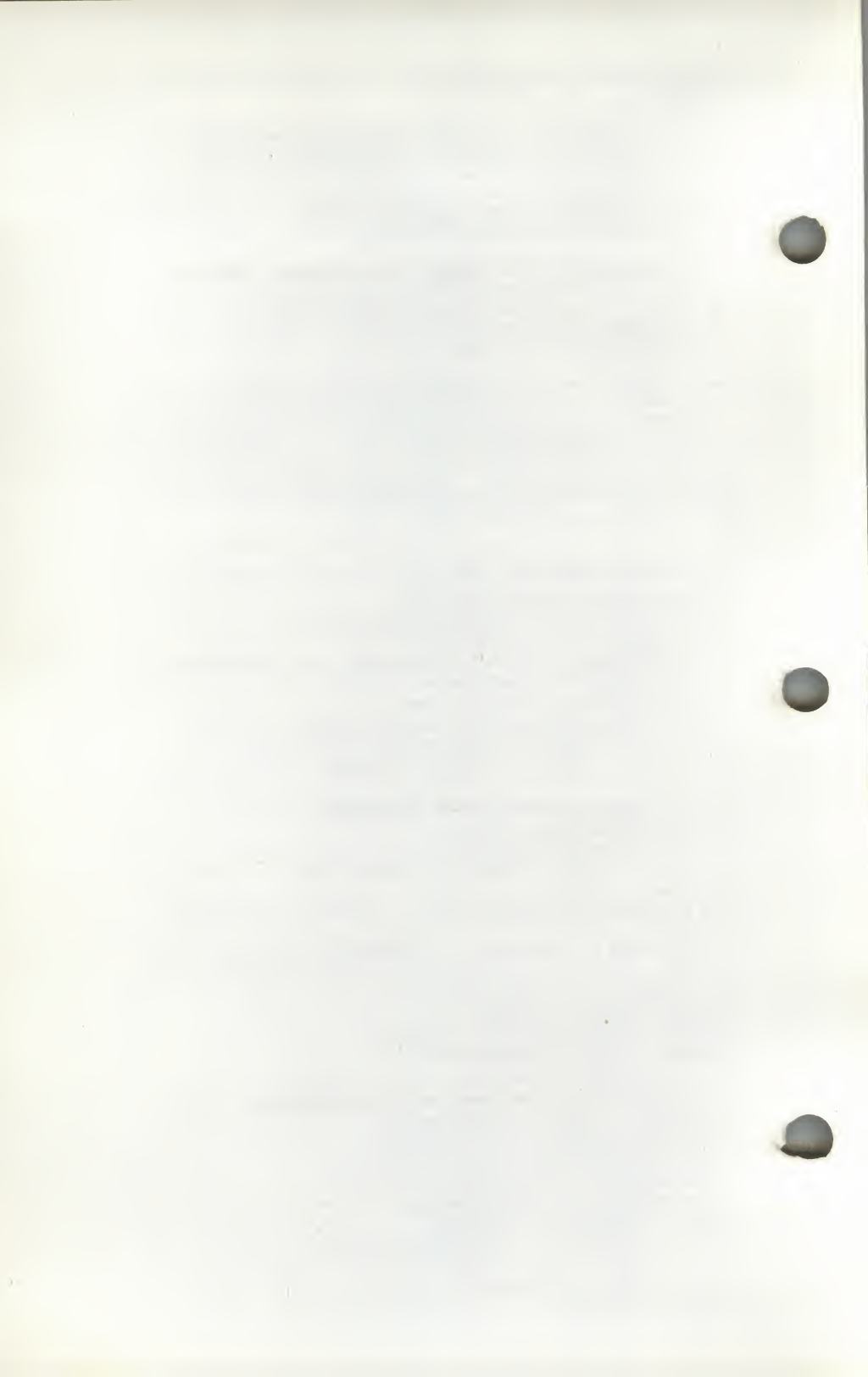
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# **SCO UNIX System V/386**

## **Operating System Release Notes**

### **Release 3.2.0**

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1. Preface 1
  - 1.1 Contents of the Distribution 2
  - 1.2 Encryption Software Package Availability 3
  - 1.3 Conventions Used in These Notes 3
  - 1.4 Packages in This Set 3
    - 1.4.1 An Explanation of custom(ADM) Packages 5
  - 1.5 Software Support 7
2. Notes About Installing Your Software 7
  - 2.1 Installing the Maintenance Supplement Diskettes 7
  - 2.2 Setting Your Machine Name 10
  - 2.3 If you Create Additional Filesystems 12
  - 2.4 An Important Security Note 12
  - 2.5 Before You Start 12
  - 2.6 Memory Requirements 15
  - 2.7 Notes on Using custom(ADM) 15
  - 2.8 ESDI Notes for Standard Architecture Machines 15
  - 2.9 SCSI Notes 16
  - 2.10 Installing on Microchannel Architecture Machines 17
3. Special 386 Microprocessor Notes 17
  - 3.1 80386 32-bit Multiply Bug 17
  - 3.2 Intel 387 Co-Processor Problems 18
  - 3.3 Using an Intel Inboard in High Speed Mode 19
4. Administering Your System 19
  - 4.1 fsdb(ADM) Documentation 20
  - 4.2 The assign(C) Command 20
  - 4.3 Setting Up Backups for a /u Filesystem 21
  - 4.4 Cleaning and File Protection of /tmp Directory 21

## Operating System Release Notes

- 4.5 fsck(ADM) and Raw Devices 22
- 4.6 mount(ADM) 22
- 4.7 New Filesystem Support 22
- 4.8 New Security Features 23
  - 4.8.1 File and Directory Protection 26
  - 4.8.2 Security and MS-DOS-under-UNIX Options 26
  - 4.8.3 Creating a New Subsystem 28
  - 4.8.4 Default User Shell Selection 29
  - 4.8.5 Known Security Limitations 29
- 4.9 UUCP Anonymous Login Accounts 30
- 4.10 POSIX Additions 30
  - 4.10.1 Restricted chown 31
  - 4.10.2 Parent/Group ID on Files 31
  - 4.10.3 Multiple groups 31
  - 4.10.4 Archiving tools 32
  - 4.10.5 Job Control 32
  - 4.10.6 Filename Truncation 32
- 4.11 AT&T Installation Tools 32
- 4.12 fdisk(ADM) Enhancement 32
- 4.13 /etc/rc Modifications 33
- 4.14 MMDF Mail Router 33
  - 4.14.1 MMDF cleanque(ADM) Program 34
  - 4.14.2 Known Limitations 34
- 4.15 sar and sag Activity Reporting 35
- 4.16 New System Administrator's Guide 36
- 4.17 System Administration Shell Modifications 37
- 4.18 Obsolete XENIX Commands 37
- 4.19 Obsolete UNIX Commands 38
- 4.20 New Commands/Pages Added 39
- 4.21 Data Encryption Documentation 40
- 4.22 Filesystem Backup Modifications 40
- 4.23 Filesystem-specific Utilities 42
- 4.24 UNIX Process Accounting Facilities 43
- 4.25 SCO Professional Fix (386 version) 43
- 4.26 Floating Point Emulation 44
- 4.27 /etc/default/login and PASSREQ=no 45

5. Using Your System 45
  - 5.1 ct(C) Remote Terminal Program 45
  - 5.2 help(C) Command Help Facility 45
  - 5.3 Bourne Shell Nesting 45
  - 5.4 mkdir(C) Additions 46
  - 5.5 vsh(C) Obsolescence 46
  - 5.6 New User's Guide Chapters 46
  - 5.7 mscreen(M): Serial Multiscreens 47
  - 5.8 New Mail User Interface 47
6. Using the System Console and Terminals 47
  - 6.1 Console Display Problems When Booting 47
7. Using Printers 48
  - 7.1 Extended UNIX Printer Spooler 48
  - 7.2 Setting Printer stty Options 48
  - 7.3 consoleprint(ADM) 48
  - 7.4 Slow Parallel Printers 48
8. Using Floppies and Tapes 49
  - 8.1 Creating Backups with Irwin and QIC-40 Drives 49
  - 8.2 SCSI Tape Drives and ECC 50
  - 8.3 tape(C) and format(C) Modifications 50
  - 8.4 The tape servo Command 50
  - 8.5 The tape load/unload Commands 50
  - 8.6 sysadmsh(ADM) and tapedump(C) 50
  - 8.7 sysadmsh(ADM) Backup→Integrity Selection 51
9. Using a Mouse 51
10. Using MS-DOS and OS/2 51
  - 10.1 MS-DOS-UNIX Partition Coexistence 51
  - 10.2 MS-DOS Filesystem Support 52
11. Using Networks 52
  - 11.1 UUCP Example Changes 52
  - 11.2 Changing the UUCP Sitename 53
12. System Configuration and Link Kit Notes 53

## Operating System Release Notes

- 12.1 Streams Support 53
- 12.2 Layers Support (Blit Terminals) 53
- 12.3 10-bit I/O Addressing Check 54
- 12.4 idcheck(ADM) 54
- 12.5 Kernel Operations 54
- 13. Internationalization 55
  - 13.1 Internationalized Utilities 55
  - 13.2 Documented Features not Present in this Release 55
    - 13.2.1 echo(C) 55
    - 13.2.2 file(C) 56
    - 13.2.3 more(C) 56
    - 13.2.4 grep, egrep, fgrep(C) 56
  - 13.3 Utilities Not Yet Internationalized 56
- 14. Compatibility and Conformance Notes 56
  - 14.1 Security Standards Conformance 57
  - 14.2 XENIX System V Compatibility 57
    - 14.2.1 System Calls that Differ in Release 3.2 58
    - 14.2.2 XENIX-286 Application Execution 59
  - 14.3 AT&T SVID Conformance 59
  - 14.4 POSIX P1003 Conformance 59
  - 14.5 FIPS PUB 151-1 59
  - 14.6 The ISO 8859 Character Set 60
  - 14.7 X/Open CAE Conformance 60

Release Notes  
SCO UNIX System V/386  
Operating System  
Release 3.2.0  
August 7, 1989

## 1. Preface

This document contains important information about the SCO UNIX System V/386 Operating System Release 3.2. These notes are divided into two parts: software notes and an appendix, "Compatible Hardware."

The software notes are organized into the following sections:

- Notes About Installing Your Software
- Administering Your System
- Using Your System
- Special 386 Microprocessor Notes
- Using the Console and Terminals
- Using Printers
- Using Floppies and Tapes
- Using a Mouse
- Using MS-DOS and OS/2
- System Configuration and Link Kit Notes
- Compatibility and Conformance Notes



## Operating System Release Notes

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### *Note*

Please read through the "Notes About Installing Your Software" section of these *Release Notes* before installing the SCO UNIX System V/386 Operating System Release 3.2. In addition, pay particular attention to the sections pertaining to peripheral devices such as printers, tape drives or other hardware you are installing.

Also, please note that certain hardware configuration information included in Appendix A of these notes may be required for successful installation. Please refer to those sections of Appendix A that apply to the hardware in your configuration if you have trouble installing the operating system.

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We are always pleased to hear of users' experiences with our product, and recommendations of how it can be made even more useful. All written suggestions are given serious consideration.

### **1.1 Contents of the Distribution**

The UNIX System V/386 Operating System Release 3.2 is distributed on 96tpi and 135tpi diskettes for standard architecture machines. The distribution on 96tpi diskettes is as follows:

Volumes N1-N5

Volumes B1-B8

Volumes X1-X10

Maintenance Supplement Diskettes UFA1-UFA2

The distribution on 135tpi disks is as follows:

Volumes N1-N5  
Volumes B11-B7  
Volumes X1-X8

Maintenance Supplement Diskettes UFA1-UFA2

The UNIX System V/386 Operating System Release 3.2 is distributed on the following 135tpi diskettes for microchannel architecture machines:

Volumes N1-N5  
Volumes B1-B7  
Volumes X1-X8

Maintenance Supplement Diskettes UFA1-UFA2

The software is grouped into packages that are listed in the next section, "Packages in This Set."

## 1.2 Encryption Software Package Availability

The **crypt(C)** command and libraries are not distributed with the UNIX System V/386 Operating System or Development System. The distribution of encryption software to sites outside the United States is prohibited by the U.S. government. If you want the **crypt(C)** utility and associated **crypt(S)** libraries, and you are located within the United States, contact the support center listed on the support information card included with the software.

## 1.3 Conventions Used in These Notes

Utilities and commands are printed in **boldface** type, with the Reference Guide section following in parentheses. Filenames are *italicized*.

## 1.4 Packages in This Set

The SCO UNIX System V/386 Operating System software is grouped into packages. This makes customizing your system easier, since you can use the **custom(ADM)** utility to add or delete groups of programs that have related functions.

## Operating System Release Notes

For example, if you do not want to use your system for communications, you would not install the UUCP package. If you install a package, then change your mind later, use **custom** to remove that package. **custom** can locate all the files that belong in a certain package and delete them, thus removing the package.

The packages in the SCO UNIX System V/386 Operating System are listed below. The sizes are in 512 byte blocks. Please note that this is a sample listing only. The actual sizes of the packages in your set may differ from those shown here. Use **custom(ADM)** to determine the actual sizes in your set.

### UNIX System V/386 Operating System Packages

Package	Size (512 byte blocks)	Use/Contents
ALL	52844	Entire Operating System set
PERM	150	UNIX contents and permissions list
RTS	24366	UNIX run time system
BACKUP	314	System backup and recovery tools
BASE	2162	Basic extended utility set
CSH	144	The C-shell
MS-DOS	504	MS-DOS utilities
EX	494	The ex and vi editors
FILE	1122	File manipulation tools
LAYERS	372	System V Layers
LPR	3824	Multiple line printer spooler
MAIL	5350	Electronic mail and micnet
MAN	3450	Operating System Manual Pages
MAPCHAN	238	International character set mapping
MOUSE	152	Mouse and graphic input devices files
SYSADM	1290	Additional system administration tools
TPLOT	610	Tplot, Graph, and Spline
UUCP*	2280	Uucp and cu communications utilities
LINK	4710	System V Link Kit files

- \* The SCO UNIX Operating System Release 3.2 is designed to meet the requirements of the the C2 level of "trust" as defined by the *Trusted*

*Computer System Evaluation Criteria*, also known as the "Orange Book." If you plan to follow these guidelines, those software packages marked by an asterisk must not be installed on your system. By not installing these packages, you can ensure that your system operates at a greater level of security.

#### 1.4.1 An Explanation of custom(ADM) Packages

This section explains briefly what each package contains.

RTS	All the system software you probably need to run most applications. Many installations use just this, which is all the software loaded before the installation executes the <b>custom(ADM)</b> program.
BACKUP	The utilities necessary to make copies of the files on your system. With this package, you can back up everything or just the files that have changed recently. You can also restore any part of these backups.
BASE	The basic set of system utilities that are normally installed beyond the RTS package.
MS-DOS	A set of utilities that allow listing, moving and copying MS-DOS files from a MS-DOS diskette or MS-DOS partition.
EX	The vi(C) screen-oriented text editor that includes the ex(C) editor.
FILE	A number of useful programs for comparing and manipulating files.
LAYERS	A window facility for AT&T Blit terminals. The driver must be linked into the kernel to use this package.
LPR	The printer spooler, which allows multiple print jobs to be queued for printing automatically.



## Operating System Release Notes

MAIL	This includes a number of subsystems that allow the transport of mail within the system and to other systems. The Micnet local network that permits the transfer of files and execution of remote commands is in this package, as well as the MMDF mail routing system.
MAN	This package includes on-line copies of the (ADM), (C), (F), (HW), and (M) manual pages.
MAPCHAN	Allows the use of hardware that uses different character sets. For example, a terminal using one character set can send a file to a printer using another character set without jumbling the results.
MOUSE	The utilities necessary to use mice, graphics bit pads, etc. with the system. Note that the kernel must be rebuilt using <b>mkdev mouse</b> before these will work correctly.
SYSADM	The <b>sysadmsh</b> (ADM) system administrator menu interface and other tools used to administer the system.
TPLOT	Utilities for generating graphs. These programs work on a limited set of hardware.
UUCP	Utilities to connect your system locally or to a worldwide network of other systems.
LINK	The tools necessary to rebuild the system kernel, which is necessary if you are adding additional capabilities to your system such as tape drives, multiport serial cards, mice, MS-DOS filesystem support, and third party device drivers.



## 1.5 Software Support

Software support is available to customers who purchased the SCO UNIX System V/386 Operating System for use in the United States and Canada. If you purchased it for use outside of the US or Canada, contact your distributor or retailer for support information.

Software support is described on an insert in the back of the UNIX documentation.

## 2. Notes About Installing Your Software

Please refer to the *Installation Guide* in the binder marked "SCO UNIX System V/386 Operating System *System Administrator's Reference*" to install the SCO UNIX System V/386 Operating System. Chapter 2, "Installation Procedure," describes the actual installation steps.

If you have both systems, (the Operating System, and Development System) you can use the *Installation Guide* to install them both at once. If you wish to install the Development System at a later time, refer to the *Release Notes* at the beginning of the appropriate guide. Also see the manual page for **custom**(ADM). With **custom** you can install all or portions of the UNIX System.

### 2.1 Installing the Maintenance Supplement Diskettes

The Maintenance Supplement floppies provided with your distribution contain important software fixes that have been added to the SCO UNIX System V/386 Release 3.2. The floppies are **custom** installable and should be added after installing the Operating System, as instructed below.

The following are some of the important changes included on the Maintenance Supplement floppies:

- Modifications were made to **cpio**(C) to support multivolume tape backups.
- The TZ (timezone) variable is now set by **init** for each process. A number of system files were modified so they no longer duplicate this effort.

## Operating System Release Notes

- If **haltsys** or **reboot** are called from a mounted filesystem, that filesystem will be unmounted and marked clean before the system halts.
- Several shutdown problems fixed:
  - If there is a **graceperiod** (greater than 0), the **wall** message (if used) is displayed.
  - Usage of **su** was eliminated to solve the problem of failing **wall** messages.
  - The single user **init** state code was inconsistent and has been changed to conform with the behavior documented in the **shutdown** man page.
- Several **cs**h bugs were fixed; pathnames are now resolved properly, and **cs**h now uses **dirent** routines to access directories over networks.
- **mnt** modified to call **fsck** using the block hard disk device, solving problems with **autoboot** mounting filesystems.
- The **BUTTONS** field was removed from the */usr/lib/event/devices* file. **BUTTONS** is not supported in programs compiled with earlier versions of the event library (for example: **CGI**, **VPIX**).
- The man page index was updated.
- A new */etc/conf/patch/kernel/locore.o* is provided to allow the serial driver to work reliably at speeds exceeding 4800 baud.
- Several kernel bugs were fixed.

You must install the Maintenance Supplement floppies immediately after you complete the Installation Procedure, and prior to allowing users to log on. To install the Maintenance Supplement floppies, follow these steps:

1. Log in as root and enter this command, followed by <Return>:

**custom**

2. The main **custom** menu is displayed. Press <Return> to select *Install*.
3. A window opens in the lower right-hand corner. Press <Return> again to select *A New Product*.
4. The *Entire Product* selection is highlighted next. Press <Return> to select this option.
5. You are then prompted to insert "Distribution Volume 1." Insert the UFA1 floppy. After a few moments, you will be prompted to insert the UFA1 floppy by name; press <Return>.
6. You are next prompted for the UFA2 floppy. Insert it as instructed and press <Return>.
7. If you did not install the LINK (Link Kit) package earlier, you will be asked to insert certain Operating System distribution volumes (this will install the Link Kit), and to reinsert the UFA1 and UFA2 floppies.
8. After both UFA floppies are loaded, the RESTRICTED RIGHTS LEGEND is displayed and you are prompted for your serial number and activation key. Enter them just as you did during the Operating System installation.
9. Relinking of the kernel will then proceed. A series of messages are displayed to indicate the progress of the kernel relink and the resetting of the kernel environment.

## Operating System Release Notes

10. After the kernel is relinked, file permissions are checked and you are returned to the main **custom** menu. Press **q** to Quit, or use the left arrow key to select *Quit* and press <Return>. You are asked to confirm your choice, then **custom** exits.
11. Next, you must shut down the system and reboot to ensure that the modifications take effect. Enter the following command:

**/etc/haltsys**

12. The reboot message is then displayed:

```

**      Safe to Power Off      **
      - or -
** Hit Any Key to Reboot **
```

Press <Return> and the system will restart. The system is now ready for use.

### 2.2 Setting Your Machine Name

During installation, if you install the MAIL package (or the entire product) you will be prompted to provide a name for your machine. You should select to change the name from **scosysv**, or, even if you want to keep **scosysv**, select to change the name and enter **scosysv**. This will ensure that the system name is consistent throughout the system files.

To change your system name after installation, you must log in as **mmdf** and do the following:



1. Move to the **mmdf** directory:  
**cd /usr/mmdf**
2. Edit the *mmdftailor* file and alter the **MLNAME** and **UUName** entries at the top of the file to reflect the desired name change. In addition, any other occurrences of the old system name in this file should be changed to reflect the new name.
3. Edit any *\*.dom* and *\*.chn* files in the */usr/mmdf/table* directory and change all instances of the old system name to reflect the new system name.
4. Enter the following commands:  
**cd /usr/mmdf/table**  
**./dbmbuild**

Your system will then use the new name.



## Operating System Release Notes

### 2.3 If you Create Additional Filesystems

If you create additional filesystems during the installation (example: */u*) then you need to change the ownership and permissions of the mount point. After your installation is complete and your machine is ready for general use, log in as **root** and enter the following commands, substituting the filesystem name for *directory* (omit the **mount** command if the filesystem is already mounted):

```
mount /dev/filesystem /filesystem
chmod 775 /filesystem
chgrp auth /filesystem
```

### 2.4 An Important Security Note

The security mechanisms present in this release include modifications to the way passwords are controlled, maintained and stored. UNDER NO CIRCUMSTANCES SHOULD YOU EDIT THE */etc/passwd* FILE WITH A TEXT EDITOR. This will cause error messages to be displayed and could cause the system not to accept further logins. Use the **sysadmsh** Accounts selection to modify or add user accounts. The */etc/passwd* database has been expanded into an adjunct Protected Password database, which stores the encrypted version of the password and other security parameters about each user.

### 2.5 Before You Start

If you are upgrading your computer to Release 3.2, you can continue to use a pre-3.2 XENIX filesystem on a second hard disk by following the instructions in the section "Reestablish Your Second Hard Disk" in the "Reinstalling and Updating Your System" chapter of the *Installation Guide*. Read the *Release Notes* and *Installation Guide* and make sure you completely understand the installation process before installing the product.

In addition, take note of the following points:

- If you need to stop the installation process because you enter incorrect information or for some other reason, press the computer "reset" button or turn the power off and on and start the process again from the beginning rather than trying to proceed from the stopping point. Do not abort the installation process by using the <DEL> or <CTL>\ keys unless a message appears to explicitly tell you to abort in this way.
- If you need to start the installation process over and you have already installed on the hard disk, you can start over by entering **restart** at the Boot: prompt.
- UNIX and MS-DOS must boot from the physical drive 0 (hard disk or diskette). Keep this in mind when planning for extra hardware.
- The SCO UNIX System V/386 Operating System Release 3.2 installs with a minimum of screen prompts and typing, and is set up with ample defaults for most uses and sites. However, you can customize the operating system during installation to meet a wide variety of needs.

If you know that you need to customize your installation, go over this next list and decide if any of the items apply to you. If they do, read any suggested sections and make sure you understand the procedures involved before installing:

- Install all or only parts of the operating system.

This is described during the installation process, but the section of these *Release Notes* "Contents of the Distribution" can help you decide what software you need, and what software you may not need.

## Operating System Release Notes

- Create additional filesystems, besides the *root*.
- Use an ESDI or SCSI disk for your root hard disk.

This is described in the sections “ESDI Notes” and “SCSI Notes” later in this chapter.

- Reestablish a second hard disk that contains filesystems created under XENIX 2.3. You can continue to use the filesystems on a second hard disk that you created under XENIX 2.3 or later.

- Set up your hard disk to accommodate other operating systems, such as MS-DOS.

This is discussed in the “Using MS-DOS and OS/2” chapter in the *System Administrator's Guide*. Note that only MS-DOS 3.3 or earlier are supported for use with the Operating System.

Most users and sites do not need to extensively customize their installations, since the defaults satisfy most requirements. If you need to customize your installation, though, make sure you have a clear idea of what you want before you start the actual installation process.

## 2.6 Memory Requirements

Please use the following table to determine the amount of memory you need to run the SCO UNIX System V/386 Operating System and Development System:

System	Requirements
Operating System	minimum: 3MB recommended: 4MB multiuser: 4MB or more for optimum performance
Development System	<b>minimum: 3MB</b> <b>recommended: 4MB,</b> or more for optimum performance.

The Operating System requires at least 40MB of disk space (after formatting) to operate efficiently, including space for user files and swap space. If you plan to have security auditing enabled, much more disk space will be necessary to maintain the audit record files.

## 2.7 Notes on Using custom(ADM)

The **custom(ADM)** utility now uses SCO Portfolio-style menu screens instead of straight option lists.

## 2.8 ESDI Notes for Standard Architecture Machines

This section provides general information for SMS OMTI 8620 and 8627 disk drive controllers under SCO UNIX System V386 Release 3.2 for 386 personal computers. See Appendix A, "Supported Hardware," for installing hardware, configuring software, and performing low-level formats on new disks and discussion on badtracking and disk space usage.

This product supports one SMS OMTI 8620 or 8627 controller with up to two drives attached to it. Either or both drives may have an ESDI or ST506 drive interface. An OMTI-specific device driver supplements the Western Digital-specific device driver.



## Operating System Release Notes

See also the following sections in Appendix A, "Supported Hardware," "ESDI Guidelines," which provides information on hardware configuration. Note that ESDI disks attached to controllers such as WD1007 that act as straight disk controllers need no special handling.

### 2.9 SCSI Notes

For standard architecture machines the SCO UNIX System V/386 Operating System runs on industry standard 386 based systems with an Adaptec AHA-154x SCSI host adapter instead of, or in addition to, a standard Western Digital (or compatible) disk controller.

For microchannel architecture machines the SCO UNIX System V/386 Operating System runs with an Adaptec AHA-1640 SCSI host adapter.

---

#### *Note*

If your root disk is an ST506 or ESDI, only one SCSI secondary disk is supported at this time.

If you are planning to add a SCSI tape and a secondary SCSI disk, add the tape first, or the entries for your disk will be removed.

If you add a second SCSI to a system with a SCSI root disk, invoke **mkdev hd** without arguments and the second disk will install successfully. Using the extended syntax will cause the command to fail.

---

This release only supports initiator mode for host adapters (not target mode). This means that you cannot connect a host adapter to another host adapter on a different computer because the second host adapter would need to be set in target mode.

If a SCSI disk is going to be your primary disk, you must run your computer's **setup** program and set the computer up for operation



*without* a hard disk before installing the operating system.

This forces the computer to recognize the AHA-154x (for standard architecture machines) or the AHA-1640 (for microchannel architecture machines).

For more information on SCSI systems, see the following: "SCSI Guidelines" in the "Supported Hardware" section of these *Release Notes*, which provides information on hardware configuration and formatting a SCSI disk.

## **2.10 Installing on Microchannel Architecture Machines**

To install the SCO UNIX System V/386 Operating System on a microchannel architecture machine, follow the installation procedure described in Chapter 2, "Installation Procedure", of the *Installation Guide*. However, note the following points while reading the installation instructions:

- Where the ST506 (standard interface) controller is mentioned, read the following:  
". . . ST506 (standard interface) controller or an ESDI controller . . ."
- The OMTI controller is not supported for microchannel architecture machines.

## **3. Special 386 Microprocessor Notes**

The following are notes that apply to known problems with 80386 chips.

### **3.1 80386 32-bit Multiply Bug**

There is a serious, but not immediately apparent problem that affects some 386 CPU chips. Although the computer and operating system may appear to function normally, this hardware problem can cause damage to data and programs.

## Operating System Release Notes

If you see the following message when you boot your system then your computer has a defective 80386 chip:

```
HARDWARE FAILURE:
386 incorrectly multiplies 32 bit numbers
```

In addition, the system will *panic*. At your own risk, you may override this protection mechanism by adding the keyword *mulbug* to the boot line:

```
Boot
: unix mulbug
```

We do **NOT** recommend using a machine with this hardware problem. Systems with this hardware problem are not supported.

Note that 80386 chips marked "16 bit only" might not present the multiply bug problem, but might also fail. Chips marked " $\Sigma$   $\Sigma$ " have been verified by Intel to function correctly.

### 3.2 Intel 387 Co-Processor Problems

Because of design defects in Intel's 80386 chip (B1 stepping), the Intel 80387 math co-processor may not operate correctly in some computers. The problem causes the SM CPU to hang when DMA/paging/coprocessor accesses are occurring. A workaround for this problem has been engineered that is engaged by using a special string at boot time:

```
Boot
: unix a31
```

This workaround may not work on all machines; some hardware, such as microchannel architecture machines, is designed so that it will not work. If it is successful, the following message is displayed:

```
A31 CPU bug workaround in effect
```

If unsuccessful, the following is displayed:

```
A31 CPU bug workaround not possible for this machine
```

The bootstring may also be added to the end of the default

bootstring (DEFBOOTSTR) found in */etc/default/boot*, so that it need not be entered manually each time the system boots, as in the following example:

```
DEFBOOTSTR=hd(40)unix a31
```

If you cannot use this workaround, you have two options. You may replace the 386 chip with a newer release of the 386 chip (a D-step part), or you can bypass the 387 chip by adding the *ignorefpu* keyword in your boot command as follows:

```
Boot
: unix ignorefpu
```

This means that the operating system will not use the 387 chip, but you need not remove it physically; the coprocessor is still usable from MS-DOS. To automatically bypass the 387 chip every time you boot your system, add the *ignorefpu* keyword to the */etc/default/boot* file. See **boot(HW)** for more information.

### 3.3 Using an Intel Inboard in High Speed Mode

The Intel Inboard is a plug-in card for a 286 AT standard architecture machine, that replaces the 286 cpu with a 386 cpu. To utilize the high-speed, cache mode of the Intel Inboard, add the keyword *inboard* to the boot line:

```
Boot
: unix inboard
```

To automatically use this mode of the inboard every time you boot the system, add the "inboard" keyword to the */etc/default/boot* file. This parameter is passed to the kernel and sets the mode of the board. See **boot(HW)** for more information.

## 4. Administering Your System

This section discusses new features that affect the administration of your system.

## Operating System Release Notes

### 4.1 fsdb(ADM) Documentation

The documentation on using **fsdb** found in Chapter 4 of the *System Administrator's Guide* "Using Filesystems" contains two errors relating to the usage of filesystem data gathered from **divvy**(ADM). The errors are found on page 4-21 in Step 1:

- The sentence: "Subtract the beginning block from the end block to obtain the filesystem size" should read "Subtract the beginning block from the end block, *then add 1 to the result* to obtain the filesystem size."
- The inode approximation number should be **.25**, not **.125** as documented.

### 4.2 The assign(C) Command

If you wish to use the **assign**(C) utility (which allows the system administrator to assign a device to a specific person and disallow access to anyone else) some modifications are necessary. Follow these steps:

1. Change ownership of the **/dev** directory: (user **bin** has to be able to write a lock file in **/dev**)

```
chown bin /dev
```

2. Change the ownership of the specific *devices* to **asg** and change their mode to disallow access to others:

```
cd /dev
chown asg devices
chmod 660 devices
```

Make certain you invoke **assign/deassign** from a terminal where the output of both the **:ty**(C) and **who**(C) indicate the same device. If this isn't the case, **assign** gives a "No tty" error. This often happens on **tty01** (which is also usually known as **/dev/syscon**).



### 4.3 Setting Up Backups for a /u Filesystem

The documentation on preparing for backups found in Chapter 6 of the *System Administrator's Guide*, "Backing Up Filesystems" requires the following procedure that is missing from Page 6-7, replacing the second paragraph under "Edit the Backup Schedule Table" and above Figure 6-3. If you add a /u filesystem, this procedure should be followed immediately after completing the UNIX system installation. This ensures that the backup programs will recognize the additional filesystem.

The replacement text follows:

If you do not have a /u filesystem, then your user accounts are located in the root filesystem (in the directory /usr). If this is so, the schedule table is pre-configured to back-up the root filesystem. However, if you have added a /u filesystem, edit the schedule table and add an entry for /dev/ru, as shown in Figure 6-3.

### 4.4 Cleaning and File Protection of /tmp Directory

The cleaning of the /tmp temporary directory is no longer performed at each reboot as it was under XENIX. Instead, the directory is cleaned (files removed) according to the aging limit defined in the file /etc/default/cleantmp. The default is 7 days, meaning that each day all files in /tmp that are older than 7 days are removed. See the cleantmp(ADM) manual page in the *System Administrator's Reference* for details.

In addition, the sticky bit is set by default on the /tmp directory, which means that only file owners and the super-user can remove files created in /tmp. The sticky-bit directory protection feature is discussed in "The Sticky Bit and Directories" in the "Maintaining System Security" chapter of the *System Administrator's Guide*.

## Operating System Release Notes

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### Note

#### For CGI Installations

Due to the sticky bit being set on */tmp*, CGI cannot delete the lock files it creates in that directory. To prevent this problem from occurring, remove the sticky bit from */tmp* if you have CGI installed. To remove the sticky bit on */tmp*, log in as **root** and enter the following command:

```
chmod 777 /tmp
```

---

#### 4.5 fsck(ADM) and Raw Devices

**fsck(ADM)** does not work on raw devices (example: */dev/ru*) at this time. Use block devices instead. If you must **fsck** raw devices, invoke the proper filesystem-specific binary (*/etc/fscmd/fstype/fsck*). This will be fixed in a future release.

#### 4.6 mount(ADM)

**mount(ADM)** has a new flag, **-v**, which displays verbose output that echoes the filesystem type and other mounting information.

#### 4.7 New Filesystem Support

The SCO UNIX Operating System Release 3.2 supports four different types of filesystems:

- XENIX
- S51K (UNIX)
- MS-DOS
- AFS (Acer Fast Filesystem)

The default filesystem is a fast filesystem called AFS (Acer Fast Filesystem), which is significantly faster than the other filesystems. The block sizes for each of these filesystems is 1K. A UNIX

filesystem can be converted at any time to an AFS filesystem (but not the reverse). See the "Using Filesystems" chapter of the *System Administrator's Guide* for details.

---

*Note*

The 2K filesystem is not supported in SCO UNIX Release 3.2. This is because the 2K filesystem offers no advantages over the AFS (Acer Fast Filesystem).

---

#### **4.8 New Security Features**

The SCO UNIX Operating System Release 3.2 is designed to meet the requirements of the C2 level of "trust" as defined by the Department of Defense's *Trusted Computer System Evaluation Criteria*, also known as the "Orange Book." To implement the principles of trusted operation, a number of modifications have been made that greatly exceed the security features of most UNIX systems. Each aspect of operation has been complimented by simple-to-use additions to the `sysadmsh(ADM)`.

## Operating System Release Notes

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### Note

The security mechanisms present in this release include modifications to the way passwords are controlled, maintained and stored. UNDER NO CIRCUMSTANCES SHOULD YOU EDIT THE `/etc/passwd` FILE WITH A TEXT EDITOR. This will cause error messages to be displayed and could cause the system not to accept further logins. Use the `sysadmsh` Accounts selection to modify or add user accounts. The `/etc/passwd` database has been expanded into an adjunct Protected Password database, which stores the encrypted version of the password and other security parameters about each user.

---

Accountability is crucial to the operation of a trusted system. This is accomplished by stamping a user's login user ID (LUID) on every activity the user performs. This, combined with the flexible auditing system, allows the system administrator to keep track of what was done on the system when and by whom.

Here is a summary of the enhancements made to the UNIX Operating System to improve security:

- *There is no way to obscure the identity of a user by changing user ID.* The LUID is not affected by the use of `su` to access another account. Use of `su` is restricted to administrative users. The `su` authorization allows administrative users to become root, but not other users.
- *The administrative functions of the system are segregated into protected subsystems.* Groups of related commands are gathered so they can be controlled separately. For example, the Printer subsystem comprises the commands: `lpadmin(ADM)`, `lpstat(C)`, `lpforms(ADM)`, `lpfilter(ADM)`, `lpusers(ADM)`. Each subsystem is explained in detail in the `subsystem(M)` manual page.



- *Access to protected subsystems is controlled by authorizations.* All subsystems can be administered by a single **root** user or separately by assigning authorized administrators. (NOTE: this feature is not fully functional in 3.2.0) For example, a Backups administrator can be assigned the **backups** authorization. While this user is trusted with creating backups, they are not empowered to do anything else that **root** can do. By separating the powers of system administration, the risk of damaging the system or compromising security is lessened.
- *Access to certain system services is also regulated.* Following the principle of least privilege, certain commonplace UNIX services can be restricted. For example, access to the kernel process tables via the **ps(C)**, **w(C)**, and **whodo(C)** commands requires the **mem** authorization. Without this authorization (as assigned by system defaults or on a per user basis) the user can only see information relating to their own processes.
- *Auditing can be done at any level.* The audit subsystem recognizes a score of "event types" (security relevant events) that define the kinds of activities to be monitored. Auditing is central to the concept of a "trusted" system. If you are planning to use the auditing functions, be sure and enable auditing at installation time as instructed in the "Installation Procedure" of the *Installation Guide*.
- *Password checking, login checking, and system access are completely configurable.* The lifetime and complexity of passwords can be defined, as well as the number of failed login attempts allowed on a per user or terminal basis. When limits are exceeded, the account or terminal is automatically locked to prevent tampering.

If you do not plan to follow the C2 guidelines, it is possible to configure more traditional UNIX Operating System behavior.

## Operating System Release Notes

All aspects of security default configuration and adding users is covered simply in the "Administering User Accounts" chapter of the *System Administrator's Guide*. The C2 requirements for security documentation are satisfied by the "Maintaining System Security" chapter of the *System Administrator's Guide* and "Using a Secure System" in the *User's Guide*.

### 4.8.1 File and Directory Protection

SCO UNIX Release 3.2 guarantees that the SUID, the SGID, and the sticky bits are cleared on files that are written. The reason for the clearing is to prevent program replacement in a SUID/SGID program or a program that is meant to be memory-resident.

In addition, a directory with the sticky bit set means that only the file owner and the super user may remove files from that directory. Other users are denied the right to remove files. Only the super user can place the sticky bit on a directory. This feature is best used on all public directories. Use of the sticky bit, together with the default `umask` of 077, solves a big problem area of less secure systems. These enhancements are discussed in the "Maintaining System Security" chapter in the *System Administrator's Guide*.

### 4.8.2 Security and MS-DOS-under-UNIX Options

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#### Note

Installing and/or using MS-DOS under UNIX such as SCO VP/ix may invalidate auditing for a secure environment.

---

The SCO UNIX Operating System Release 3.2 is Designed to meet the requirements of the C2 level of "trust" as defined by the NCSC *Trusted Computer System Evaluation Criteria*. This means that all accesses of subjects (processes) to objects (files and devices) are subject to Discretionary Access Controls (DAC) and auditing.

There is provision in 3.2 to allow installation of MS-DOS-under-UNIX options. These processes require special privileges which are accessed using the `v86init()` system call. This system call has the potential to bypass DAC and auditing in certain cases, although this does not affect normal use of the system since it can only be issued by a process either run directly from the root login or installed as set-uid root.

When you add a MS-DOS-under-UNIX option to your system you will install some set-uid root commands which issue the `v86init()` system call. MS-DOS programs controlled by the emulation process, unlike SCO UNIX System V/386 Release 3.2, have not been modified to completely satisfy the C2 requirements.

MS-DOS programs running in this mode bypass Discretionary Access Controls (DAC) and/or auditing in the following cases:

- Direct device access using the DDA device driver (no DAC or auditing). Enable and disable of access to hardware is not a part of the standard XT hardware emulation supported by VP/ix, with the exception of the video hardware.
- Execution of certain MS-DOS processes.

Audited:

- Invocation of MS-DOS binaries (they are invoked from the UNIX partition)
- All file I/O operations are audited, with the exception of operations on the MS-DOS hard disk partition or the floppy. This can be worked around by mounting the MS-DOS hard disk partition or the floppy.

## Operating System Release Notes

Not audited:

- Accesses to memory within the MS-DOS environment (e.g. reading and writing memory using MS-DOS debug).
- Access to the MS-DOS hard disk partition or diskette.
- Access to video registers and screen memory (no DAC or auditing). Granting of access is audited, but usage by the process is not, which is the same as under the UNIX system.

### 4.8.3 Creating a New Subsystem

The system administrator can create additional subsystems as desired.

To create a new subsystem, do the following:

1. Add to the file */etc/auth/system/authorize* a line like:

*subsystem:class1,class2,...,classn*

where:

<i>subsystem</i>	the name of your new subsystem
<i>class1...n</i>	optional name(s) of the authorizations

For example:

*backup:dump,freespace*

This defines the “backup” subsystem (used to control read access to filesystems), which has two special cases: “dump”, actually make a backup of the filesystem, and “freespace”, ability to read the filesystem to determine how full it is (but for no other reason).



2. Create a group with the same name as the subsystem. Make the (empty) file */etc/auth/subsystems/subsystem*, owner **auth** or **bin**, and the group owner is the new group *subsystem* with a mode of at least 440 (the mode must not grant any write permission to "other").

You are finished creating the new subsystem. It should be automatically recognized and understood by the system and the **sysadmsh**.

### Restrictions on Subsystems

There are a few rules that must be observed:

- There can be at most 32 subsystems.
- All names must be unique.

#### 4.8.4 Default User Shell Selection

When a user account is created using the **sysadmsh(ADM)** **Accounts→User→Create**, the user shell can be chosen or taken from the system default listed in */etc/default/authsh*. Selecting or entering "sh" and "/bin/sh" in the "Login shell" field are not equivalent. If a full pathname is supplied (as in "/bin/sh"), the shell described by that pathname is simply used as the user's login shell. However, if the shell specified is not a pathname (as in "sh") it is assumed to be the name of a "pre-defined shell", a shell defined in a subdirectory of */usr/lib/mkuser*. Choosing a pre-defined shell causes appropriate shell-related files (example: *.profile* for "sh") to be copied into the user's home directory.

#### 4.8.5 Known Security Limitations

The following are known limitations related to the security mechanisms that will be fixed in a later release:

- The use of subsystem authorizations is not fully functional in this release. You are advised to use the super-user account (root) to administer your system.

## Operating System Release Notes

- The Audit sysadmsh selection **System→Audit→Report→View** has the following flaw: When you press , the point and pick menu displayed contains a “..” entry that is nonfunctional and should not be selected.
- The selection of Audit event types is not fully functional in this release. The events A-T are always audited when auditing is turned on, regardless of what events are actually selected.
- Dialup passwords cannot be assigned.

### 4.9 UUCP Anonymous Login Accounts

If you have an anonymous UUCP login account “uucp” that you have been using for anonymous logins, you should change this account to “nuucp,” which is the proper name for an anonymous UUCP login. Although use of anonymous logins is not recommended, no account should ever be without a password, and you should never use “uucp” as an anonymous login account.

If you have difficulties with UUCP accounts being locked (messages like “dead account” are displayed), you can extend the number of login attempts by selecting: **Accounts→User→Modify:Logins**. If the account has been locked due to too many unsuccessful login attempts, the “Account Locked” field will display “Too many unsuccessful login attempts”. You can clear this condition either by setting the maximum unsuccessful logins to a larger number (including infinite), or by selecting the “Lock status” option “Clear all locks”.

### 4.10 POSIX Additions

This section reviews the most significant additions made to conform to POSIX 1003 and FIPS PUB 151-1. (See the “Standards Conformance” section for a detailed account of conformance issues.)

#### 4.10.1 Restricted chown

This is implemented via the "chown" system kernel authorization. (See "Security Features" for an explanation of the new security additions.) If a site wishes to be FIPS compliant, the system administrator must remove the chown system privilege from the set of authorizations for default users as described in the "Default Account Configuration" in the "Administering User Accounts" chapter of the *System Administrator's Guide*.

#### 4.10.2 Parent/Group ID on Files

This is governed by setting the GID bit on directories. If the GID bit is set on a directory, files created within that directory will have the group ID of the parent directory instead of that of the user or creating process. Without this bit, the GID of a new file is set to that of the creating process/user. See "Setting Directory GID Bit" in the "Maintaining System Security" chapter of the *System Administrator's Guide* for details.

#### 4.10.3 Multiple groups

The system allows any user to simultaneously be a member of up to 8 groups. This is a kernel parameter NGROUPS, which can be altered using `configure(ADM)`. See "Adding/Changing Groups" in the "Administering User Accounts" chapter of the *System Administrator's Guide*. Note that IPC processes (shared memory, semaphores) only pay attention to the primary group in Release 3.2.0.

## Operating System Release Notes

### 4.10.4 Archiving tools

POSIX **pcpio(C)**, **ptar(C)** and **pax(C)** are included.

### 4.10.5 Job Control

There is not yet shell support for job control. The suspend character will not work. The underlying mechanisms are in place and programs can be written to use job control (see the *Development System Release Notes* for details).

### 4.10.6 Filename Truncation

POSIX FIPS requires the system to return an error when asked to create files with names longer than 14 characters (via **open()**, **creat()**, etc.). The shells **csch(C)** and **sh(C)** have been modified to detect this error and truncate the name of the file. However, other programs may fail when attempting to create long filenames (in particular, */tmp* files). The programs must be modified to detect this error and act accordingly.

### 4.11 AT&T Installation Tools

The AT&T package installation tools (**installpkg(ADM)**, **displaypkg(ADM)**, **removepkg(ADM)**) are included in this release to permit the installation and maintenance of AT&T-style installable packages. These utilities do not access or affect **custom(ADM)** installed or installable products. If **custom** is used to install AT&T-style packages, the **installpkg** program will be invoked automatically.

### 4.12 fdisk(ADM) Enhancement

**fdisk** now includes a "Use Rest of Disk for UNIX" option in the main **fdisk** menu. This is intended for installations with a single non-UNIX partition already existing on the disk.



#### 4.13 /etc/rc Modifications

The structure of */etc/rc* has been modified to integrate the XENIX */etc/rc* into the UNIX structure. Consult the "Starting and Stopping the System" chapter of the *System Administrator's Guide* for details on adding files to the */etc/rc* structure and the *rc0(ADM)* and *rc2(ADM)* manual pages.

#### 4.14 MMDF Mail Router

This release includes the Multi-channel Memorandum Distribution Facility (MMDFIIB, update #32) as a mail router. UNIX uses MMDF to route mail locally and over Micnet, UUCP, or other networks that provide MMDF support.

The *Installation Guide* in *System Administrator's Reference* describes how to install the MAIL package using the *custom* utility. The "Setting Up Electronic Mail" chapter in the *System Administrator's Guide* describes how to convert your configuration files to MMDF format and how to tailor your system.

---

#### Note

If you only use local mail, (that is, just on your one machine) MMDF is automatically configured. When you install the MAIL package, you are prompted to provide a name for your machine. Legal names consist of a maximum of fifteen lowercase letters, numbers, hyphen or underscores.

Should you wish to configure networking or import alias and routing tables from another release, you must read the "Setting Up Electronic Mail" chapter for instructions.

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## Operating System Release Notes

### 4.14.1 MMDF cleanque(ADM) Program

The **cleanque(ADM)** program should be set up to be run by **cron** at least daily (maybe even more often, depending on mail volume) and by hand whenever you suspect a problem with mail delivery. This program cleans the queues of outdated files.

### 4.14.2 Known Limitations

The following are known problems with MMDF:

- For the MMDF mail router to accept mail to addresses which are domain-qualified (example: "curly@stooges.UUCP"), it is necessary to have the domain tables set up properly. When a domain-qualified address is presented to the router (when mail is sent to such an address), the domain portion ("UUCP" in the above example) must be found in the first argument of one of the MDMN entries in the MMDF master configuration file, */usr/mmdf/mmdftailor*. This default file needs to be modified if mail to Micnet machines with domain-qualified addresses is to work. The MDMN entry for the Micnet channel is:

```
MDMN          "Micnet", show="Micnet Domain", table=mdom
```

should be changed to:

```
MDMN          "UUCP", show="Micnet Domain", table=mdom
```

Note that it is acceptable for more than one MDMN entry to exist with the same first argument (both the UUCP and Micnet MDMN entries may have "UUCP" as the first argument). This is convenient where two different domain tables (the UUCP and Micnet domain tables) are built by separate configuration tools (the **uulist(ADM)** and **mnlis(ADM)** utilities, respectively).

- Global aliases are limited in size: the RHS (Right Hand Side) of a global alias (one defined in *alias.user* and *alias.list* in */usr/mmdf/table*) may not exceed approximately 8K bytes when fully expanded.

- Sender removal when “metoo” not set: if the “metoo” mode is not set in **mail(C)**, the **submit(ADM)** program will attempt to make sure that the sender doesn’t get a copy of a piece of mail just because an alias that the user is on is one of the recipients; this code fails if there is an alias that just maps an alias for that one user (e.g., “fredf” is mapped to “fred”, the user’s real username) which then results in the expansion of an alias to a null list which MMDF will cause to return an error message.
- 822 quoting problem: setting “ap=822” on a channel will result in the generation of some illegal addresses (e.g., local mail to fred and barney may result in “fred barney@sco.COM” being generated).
- UUCP mail address problem: incoming UUCP mail may get the local domain address added when inappropriate (e.g., mail from “machine!root” may become “machine!root@sco.COM”).
- Setting a size limit for MMDF log files: this does not work properly.
- The first time the system goes to init level 2, the system name used is “scosysv” instead of whatever was defined at install time. When the system is rebooted, the new name is used thereafter.

#### 4.15 sar and sag Activity Reporting

The **sar(ADM)** system activity reporting program has two options that are not usable as documented. The **-c** option is no longer supported and the **-d** option is currently nonfunctional and will be fixed in a later release.

**sag(ADM)** uses the **TPLOT** package, a set of graph tools that function on a very limited number of display devices, and does not work on the system console.

## Operating System Release Notes

Activity logging is on by default and record files are always generated. Refer to the `sar(ADM)` manual page in the *System Administrator's Reference* for details. You should remove these files periodically.

### 4.16 New System Administrator's Guide

The *System Administrator's Guide* is now packed in a standard book binding and the (ADM) and (HW) sections have been moved to the new *System Administrator's Reference*.

The following chapters have been added to the *System Administrator's Guide*:

- “Administering User Accounts.” This chapter explains how to add and “retire” user accounts, plus configure the default security parameters for the system.
- “Maintaining System Security.” This chapter has been completely revised and expanded for this release. The new security mechanisms and auditing functions are explained to help you make full use of the enhanced system security administration features.
- “Using the System Console and Color Displays.” The use of utilities that are specific to the console and other color displays is described, including such utilities as `multiscreen(M)`, `vidi(C)`, and `setcolor(C)`.
- “Setting Up Electronic Mail.” This chapter describes the `mmdf(ADM)` network routing program, including how to convert existing routing and alias tables to the new format.
- “Adding Hard Disks.” The configuration of additional hard disks and controllers is described in this chapter.



#### 4.17 System Administration Shell Modifications

The **sysadmsh** has been extensively enhanced for this release. New functions have been added, including entirely new branches in the structure. The new top-level selections are as follows:

- **Jobs.** This new branch controls job (process) reporting and termination facilities. This includes the ability to authorize/deny the use of job scheduling utilities: **cron(M)**, **at(C)**, and **batch(C)**. Note that users must be assigned the **chmodsugid** kernel authorization to use **at**, **cron**, or **batch**.
- **Accounts.** This selection governs the administering of user accounts, including adding/deleting users and configuring the default security scheme for the system. (This selection replaces the functions of the XENIX **mkuser** and **rmuser** utilities and the UNIX **adduser** and **deluser** utilities.)
- **Printers.** The addition of the extended UNIX print spooler has been complimented by a series of commands that make the use of printer administration much simpler.

#### 4.18 Obsolete XENIX Commands

The following XENIX commands/pages are no longer available due to their replacement by newer and/or more secure mechanisms:

XENIX Command	SCO UNIX Command
<b>aliases(M)</b>	<b>mmdfaliases(M)</b>
<b>aliashash(M)</b>	<b>mnlist(ADM)</b>

## Operating System Release Notes

capinfo(ADM)	captoinfo(ADM)
config(ADM)	configure(ADM)
hdinstall(ADM)	link_unix(ADM)
lpinit(ADM)	sysadmsh(ADM)
mkuser(ADM)	sysadmsh(ADM)
pwadmin(ADM)	sysadmsh(ADM)
rmuser(ADM)	sysadmsh(ADM)
sysadmin(ADM)	sysadmsh(ADM)
tty(F)	inittab(F)
master(F)	mtune(F), stune(F)
loginlog(F)	sysadmsh(ADM)
ipr(C)	-
runbig(ADM)	-
tid(C)	infocmp(C)

### 4.19 Obsolete UNIX Commands

The following UNIX commands/pages are not included because they have been superseded by other commands/pages:

AT&T UNIX Command	SCO UNIX Command
diskadd(1m)	fdisk(ADM)
mkpart(1m)	divvy(ADM)
passmgmt(1m)	sysadmsh(ADM)
pwchk(1m)	sysadmsh(ADM)
pwconv(1m)	sysadmsh(ADM)
cftime(4)	langinfo(F)
fs(4)	filesystem(F)
asy(7)	serial(HW)
cram(7)	cmos(HW)
display(7)	screen(HW)
qt(7)	tape(HW)

The version of **passwd**(C) in this release is different from the UNIX and XENIX versions; modifications have been made in accordance with C2 requirements. Depending on how the administrator has set up the system, users can run the **passwd** command. In addition, the new **goodpw**(ADM) command can be used to check passwords for obviousness by matching them against an online dictionary.

#### 4.20 New Commands/Pages Added

The following new utilities/pages have been added to this release by SCO:

atcronsh(ADM)	cut(C)	maxuus(F)	queue(F)
audit(HW)	dbmbuild(ADM)	maxuux(F)	queuedefs(F)
auditcmd(ADM)	deliver(ADM)	mestbl(M)	reduce(ADM)
auditd(ADM)	devices(F)	mmdf(ADM)	rmail(ADM)
auditsh(ADM)	dialcodes(F)	mmdfalias(ADM)	rmb(M)
authcap(F)	dialers(F)	mnlist(ADM)	routines(ADM)
authck(ADM)	dlvr_audit(ADM)	montbl(M)	sfmt(ADM)
auths(C)	dtox(C)	nictable(ADM)	submit(ADM)
authsh(ADM)	fdswap(ADM)	numtbl(M)	subsystem(M)
backupsh(ADM)	goodpw(ADM)	paste(C)	swconfig(C)
checkmail(C)	initcond(ADM)	pax(C)	sysfiles(F)
checkque(ADM)	integrity(ADM)	pcpio(C)	systems(F)
chg_audit(ADM)	linkunix(ADM)	permissions(F)	tables(F)
chrtbl(M)	locale(M)	poll(F)	timtbl(M)
cleanque(ADM)	logs(F)	proto(ADM)	uulist(ADM)
cleantmp(ADM)	lpsh(ADM)	ptar(C)	vectorsinuse(ADM)
col(C)	majorsinuse(ADM)	purge(C)	xtod(C)
coltbl(M)	man(C)	purge(F)	ps(C)

---

#### Note

Please remove the **ps**(C) manual page from your *User's Reference* and replace it with the manual page in Appendix B of these notes.

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## Operating System Release Notes

### 4.21 Data Encryption Documentation

Full documentation on the data encryption software (including **crypt(C)**) has been added to this release. The features are discussed extensively in the "Using a Trusted System" chapter in the *User's Guide*. Note that the software is not included in the distribution; see "Encryption Software Package Availability" in these *Release Notes* for details.

### 4.22 Filesystem Backup Modifications

The XENIX utilities **backup(C)**, **restore(C)**, and **dumpdir(C)** have been renamed **xbackup(ADM)**, **xrestore(ADM)**, and **xdumpdir(ADM)**. This was done because these utilities are specific to the XENIX filesystem. You can continue to use these utilities on XENIX filesystems, but they do not work with other filesystem types.

**cpio(C)** has been made more robust and is now the new default backup utility used by **sysadmsh**. (The UNIX tools **backup(ADM)** and **restore(ADM)** are front-ends for **cpio**.) The **schedule(ADM)** backup file now includes a "Method" field for each filesystem that indicates what backup utility, "cpio" or "xbackup" should be used when performing scheduled backups.

---

#### Note

The AT&T backup utilities **backup** and **restore(ADM)** do not work with tapes at this time.

---

It is recommended that you use the new **cpio** to perform your backups. If you are using XENIX filesystems preserved from a previous release, you can create a **cpio** backup, recreate the filesystem using **divvy(ADM)**, and then restore your **cpio** backup to the newly-created filesystem. (This will allow you to take advantage of the new, faster AFS filesystem type.)



A number of important changes were made that are not reflected in the documentation, in particular, Chapter 6 of the *System Administrator's Guide*, "Backing Up Filesystems":

- For **cpio** backups done via **sysadmsh**, the **size** field in the **schedule(ADM)** file (*/usr/lib/sysadmin/schedule*) now refers to kbytes for tapes instead of feet, which is consistent with floppy usage. For **xbackup** backups done via **sysadmsh** however, the new size values will not be interpreted correctly unless a change is made to the */usr/lib/sysadmin/fsave* file. To make this change, log in as root and enter the following commands (commands are in bold, **ed** response messages are not):

```
ed /usr/lib/sysadmin/fsave
10058
331s/sufd/kuf
*) [$METHOD=xbackup] && LEVEL=${LEVEL}kuf
332s/.$DENSITY//
w
10048
q
```

**sysadmsh** backups using **xbackup** will then function properly. Note that the backups menu displayed by **sysadmsh** will report the tape size as incorrect (60,000 feet by default) but this does not affect the backup itself. (The software will be corrected in a later release.)

- The default size for */dev/rct0* tape cartridge device in the **schedule** file is 60000 (60 MB). This means that only 60 MB tapes can be used. You can add a set of values by editing the file */usr/lib/sysadmin/schedule* and changing the */dev/rct0* Media Entry. (To edit the **schedule** file, use the **sysadmsh Backups→Schedule** selection.) For example, if you used 30, 45, and 60MB tapes, you could change the entry to look like this:

```
media /dev/rct0 d 20000 30000 45000 60000 tape erase.
```

## Operating System Release Notes

Using this example, a hyphen in the Backup Descriptor Table would indicate the default 30MB tape, and the other values can be specified as needed. Note that you cannot enter a size in the backup descriptor table that does not exist in the Media Entry. (Note that the 20000 number is the tape density, not a tape size.)

- **cpio** now has a **-K *volumesize*** option that is reflected in the **sysadmsh Backups→Create→Unscheduled** selection. The selection now includes a field for Volume Size. A default is presented, based on media type, which is obtained from the **schedule** file.
- When using any **sysadmsh Backups** selection that uses **cpio**, the default Block Size used is now 10240 (10K), instead of 512 bytes as documented. This improves **cpio** tape performance.
- When using the **Backups→View** selection, if there is extraneous output (such as the prompt for the second volume) it appears at the bottom of the screen, which is then redrawn before the scan window is displayed.

### 4.23 Filesystem-specific Utilities

The XENIX and UNIX filesystems types each have a set of filesystem-specific utilities. (The AFS type is a form of the UNIX filesystem.) These utilities are really invoked from a front-end that selects the actual binary. This means that the administrator doesn't have to know what type of filesystem is being manipulated. The directory */etc/fscmd.d/TYPE* contains the programs for each filesystem type. The filesystem-specific utilities are:

**fsck(ADM)**  
**fsdb(ADM)**  
**mkfs(ADM)**  
**ncheck(ADM)**  
**fsstat(ADM)**  
**fstyp(ADM)**

The following utilities have been modified to recognize each of the filesystem types:

**mount/umount(ADM)**  
**df(C)**

In addition, all these utilities report in 512-byte blocks.

Only **fsck** works on MS-DOS filesystems.

#### **4.24 UNIX Process Accounting Facilities**

Most of the process accounting tools (the score of programs with extensions to the name "acct") work, except for those relating to disk usage. They will be fixed in a later release.

#### **4.25 SCO Professional Fix (386 version)**

There is a problem with running SCO Professional (386 version) on Release 3.2. This is a known problem in SCO Professional that will be fixed in a later release. In order to run SCO Professional it is necessary to apply the patch described below.

Once you have installed SCO Professional, log in as **root** and enter the following commands:

```
cd /usr/lib/pro
cp calc calc.00
/etc/_fst -w calc
0x17:3c014?w 0x16eb
$q
sync
```

You can then invoke Professional as usual.

## Operating System Release Notes

### 4.26 Floating Point Emulation

Two floating point emulators are provided in the product. The default emulator, called */etc/emulator.ms*, is linked to */etc/emulator* and provides better performance than the second emulator, kept in */etc/emulator.att*. However, */etc/emulator.ms* does NOT emulate all the instructions of the 80387 processor, specifically the following:

FCOS	cosine function (80387 only)
FDECSTP	decrement stack pointer
FINCSTP	increment stack pointer
FPREM1	partial remainder (80387 only)
FRSTOR	restore saved state
FSAVE	save state
FSETPM	set protected mode
FSIN	only sine function (80387 only)
FSINCOS	sine & cosine function (80387 only)
FUCOM	unordered comparison (80387 only)
FUCOMP	unordered comparison and pop (80387 only)
FUCOMPP	unordered comparison and double pop (80387 only)

The second emulator, */etc/emulator.att*, provides complete emulation of the 80387 instruction set. However, this emulator has less performance than the default emulator. This second emulator should be used if problems occur. The problems may manifest themselves by the application core dumping with a floating point exception.

If you need to change from the */etc/emulator.ms* emulator to the */etc/emulator.att* emulator, log in as root and type the following command:

**In */etc/emulator.att* */etc/emulator***

Similarly, if you need to change from the */etc/emulator.att* floating point emulator to */etc/emulator.ms*, log in as root and type the following command:



**In /etc/emulator.ms /etc/emulator**

After you relink the proper emulator, the machine must be rebooted for the system to start using the other emulator.

**4.27 /etc/default/login and PASSREQ=no**

The PASSREQ=no entry sometimes supported in other UNIX systems is not supported in SCO UNIX System V/386 Release 3.2 due to the poor security of this feature.

**5. Using Your System**

This section concerns new features that affect users and any problems that might be encountered.

**5.1 ct(C) Remote Terminal Program**

The ct(C) program does not work in this release.

**5.2 help(C) Command Help Facility**

The XENIX **help(C)** command is obsolete and is not present in this product. The new on-line man pages available via **man(C)** and the extensive help functions available in the **sysadmsh(ADM)** are the best sources for information on using the system.

**5.3 Bourne Shell Nesting**

The behavior of the Bourne shell differs from that used under XENIX. For example, the Bourne shell script:

```
foo() {
    echo Foo: $*
}
```

```
set -- A B C
```

```
echo Before: $*
foo 1 2 3
echo After: $*
```

produces different results on SCO XENIX Release 2.3 and SCO UNIX System V/386 Release 3.2. Under XENIX, arguments to a

## Operating System Release Notes

shell function changed the arguments to the script itself, so the output of the above script is:

```
Before:      A B C
Foo:   1 2 3
After:  1 2 3
```

But in this release, the arguments “nest” (arguments to a function do not change those of the script) and the output is:

```
Before:      A B C
Foo:   1 2 3
After: A B C
```

This change makes using Bourne shell functions more intuitive.

### 5.4 mkdir(C) Additions

The **mkdir(C)** utility has an undocumented **-e** option, which uses the EUID/EGID (effective user/group ID) rather than the RUID/RGID (real user/group ID).

### 5.5 vsh(C) Obsolescence

The **vsh(C)** utility is now obsolete and is no longer part of the distribution. If you still wish to use it, contact your provider.

### 5.6 New User's Guide Chapters

The following chapters have been added to the *User's Guide*:

- “Using a Secure System.” This chapter describes how the new security features affect the user.
- “Simple Programming with awk.” This is a detailed description of how to use the **awk(C)** utility.
- “Using sed.” Uses for the stream editor **sed(C)** are demonstrated in this chapter.
- “Scheduling Jobs with cron, at and batch.” The ability to run jobs on a regular or delayed basis is explained here.

- “Using the MS-DOS Accessing Utilities.” This chapter shows how to use the MS-DOS utilities to access the MS-DOS partition indirectly and directly using mounted MS-DOS filesystems.

### 5.7 mscreen(M): Serial Multiscreens

The number of pseudo-ttys available for use with **mscreen** has been configured with the NSPTTYS tunable kernel parameter. The default number of pseudo-ttys is 16 and can be increased to a maximum of 32.

“Using Serial Multiscreens with **mscreen**” in the “Adding Ports, Terminals, and Modems” chapter describes in detail how to set up and use **mscreen**.

### 5.8 New Mail User Interface

In this release, the XENIX **mail** user interface has been merged with the **mailx** user interface; both the **mail** and the **mailx** commands access the **mailx** user interface. **mailx** is very similar to XENIX **mail** of previous releases because both were derived from the **mail** user interface from the University of California, Berkeley. In addition, most of the useful XENIX **mail** features have been incorporated into the **mailx** interface.

## 6. Using the System Console and Terminals

### 6.1 Console Display Problems When Booting

When booting up, if the console screen blanks, the cursor is gone, or the display is garbled, you may have an incompatible video card. Check “Video Adapters and Monitors” in Appendix A of these *Release Notes* for a list of supported video cards and monitors. If yours is not listed but compatible with one on the list, it should work. If not, check your card’s hardware manual to see if there are ways to configure the switch settings so the card is in an IBM-compatible emulation mode and that it is addressing the kind of monitor attached. If changing the switch settings fails, then your monitor card is incompatible and should be replaced with a compatible card.

## Operating System Release Notes

### 7. Using Printers

This section contains information about printers.

#### 7.1 Extended UNIX Printer Spooler

The full facilities of the UNIX printer spooler have been merged into this release, including the **lpfilter**(ADM), **lpforms**(ADM), and **lpusers**(ADM) utilities. However, the complex syntax of these and the remaining LP commands is simplified by use of the **Printers** selection of the **sysadmsh**(ADM).

#### 7.2 Setting Printer stty Options

When entering **stty**(C) options with the **sysadmsh**(ADM) **Printers**→**Configure**→**Parameters** selection, you must enclose the options in a set of double quotes (""). For example: "icrnl 2400 istrip". If this is not done, only the first option will be accepted.

#### 7.3 consoleprint(ADM)

This utility is not present on this release; use **lprint** for similar functionality.

#### 7.4 Slow Parallel Printers

If you have a parallel printer that prints abnormally slowly, check that your configuration matches the section "Installing a Printer" in the chapter "Using Printers" in the *System Administrator's Guide*.

If your printer is still slow, that is, on the order of four seconds per line, your printer may be deselecting itself after receiving a line of text. A kernel patch is provided to adapt your printer driver to this type of printer.

Slow printing has been seen on some models of Tandy® printers, but is not exclusively found on Tandy printers.



---

*Note*

The application of these patches can cause other classes of parallel printers to hang.

---

You can use this patch with either polled or standard lp devices.

The pound signs (#) and asterisks (\*) are prompts from the system shell and from the patching program, */etc/\_fst* do not type them in.

```
# cd /etc/conf/pack.d/pa
# cp Driver.o Driver.o.00
# /etc/_fst -w Driver.o
* patime+ad?xxx
 patime+0xad: 0x45f6 0x10f8 0xe74
* patime+ad?w 9090 9090 9090
 patime+0xad: 0x45f6=          0x9090
 patime+0xaf: 0x10f8=          0x9090
 patime+0xb1: 0xe74= 0x9090
* $q
#
```

You must then relink the kernel. Refer to the "Adding Device Drivers with the Link Kit" for relinking instructions.

## 8. Using Floppies and Tapes

This section discusses floppy and tape drives.

### 8.1 Creating Backups with Irwin and QIC-40 Drives

We recommend that tape backups be done in single user mode for most efficient use. If you see an error message stating "cannot allocate buffer" or "not enough space" while using the tape drive, reboot your system, enter system maintenance (single-user) mode and run the backup again.

## Operating System Release Notes

### 8.2 SCSI Tape Drives and ECC

Tape ECC (Error Correction Code) support is not available for SCSI tape drives at this time.

### 8.3 **tape(C)** and **format(C)** Modifications

The **format(C)** utility no longer formats tapes. The **tape(C)** command should now be used to format tapes. (The **tape format** command only applies to floppy controller-based tape drives, namely the Irwin and QIC-40 tape drives.)

### 8.4 The tape servo Command

The **tape servo** command only applies to floppy controller-based tape drives, namely the Irwin and QICs+140 tape drives. You must bulk-erase tapes before re-servoing them. This means that if a tape has already been servo-written before, you must erase it with a bulk eraser before you can servo-write it again. (See **tape(C)** for more information.) If the **tape servo** command fails, the drive light will flash rapidly. The user must reset the drive by removing the tape cartridge. The driver does not detect this condition and no error message is generated. All tape operations will fail until the tape is removed and re-inserted.

### 8.5 The tape load/unload Commands

On tape drives that do not support automatic unloading and unloading of media, **tape load** and **tape unload** typically just turn the front panel light off and on. On nine-track tape drives, these commands actually do load and unload the tape.

### 8.6 **sysadmsh(ADM)** and **tapedump(C)**

The **tapedump(C)** utility has been modified and the **sysadmsh(ADM)** **Media→Tapedump** selection does not reflect these modifications, which are as follows:

- b *num*[*bkw*]      Sets both input and output block size. *num* is the number of blocks, which can include b, k, or w to indicate the block size, which correspond to 1024-, 512-, or 2-byte blocks, respectively. If block type is not specified, b is assumed.

**-s** This corresponds to the old **-s** option documented on the **tapedump(C)** manual page.

### 8.7 sysadmsh(ADM) Backup→Integrity Selection

The **sysadmsh(ADM) Backup→Integrity** selection does not function as documented in Chapter 6 of the *System Administrator's Guide*, "Backing Up Filesystems," which indicates that the backup tape is matched against the files on the hard disk. This is incorrect; the **Integrity** selection verifies that the tape is readable by creating a listing of the contents.

## 9. Using a Mouse

The option to add a Microchannel Keyboard mouse on a standard architecture machine, using **mkdev mouse**, is not supported in this release. The kernel will relink without error, but utility programs which use the mouse will not be able to find it.

Adding a Microchannel Keyboard mouse on a microchannel architecture machine, is supported.

## 10. Using MS-DOS and OS/2

### 10.1 MS-DOS-UNIX Partition Coexistence

The UNIX System V/386 Operating System supports the coexistence of MS-DOS<sup>TM</sup> on the same hard disk. (Only MS-DOS 3.3 or earlier will work; 4.0 extended partitions are not supported.) Some versions of MS-DOS have restrictions, for example, ITT DOS releases previous to 3.10 cannot share the disk with the UNIX partition or MS-DOS. For these releases, the UNIX partition must occupy the whole disk.

As another example, an ITT MS-DOS+ release 3.20 hard disk partition should not be made larger than 32 Mbytes. Activating a larger partition will corrupt the MS-DOS+ ending cylinder. UNIX **dos(C)** commands may not work when accessing an ITT MS-DOS+ release 3.20 hard disk partition that is 32 Mbytes or larger.

## Operating System Release Notes

Likewise, some versions of NCR MS-DOS only recognizes 32MB partitions, you see the message "No operating system on fixed disk" when attempting to boot a MS-DOS partition larger than 32MB.

Whenever you use MS-DOS and the SCO UNIX System V/386 Operating System on the same disk, if in doubt, install MS-DOS first, then install the SCO UNIX System V/386 Operating System.

### 10.2 MS-DOS Filesystem Support

MS-DOS 3.3 and earlier floppy and hard disk filesystems are now mountable from the UNIX partition and their files accessible using standard file utilities. Support for this feature must be linked into the kernel. See "Using MS-DOS and OS/2" in the *System Administrator's Guide* for details.

### 11. Using Networks

Because no standards exist for "trusted" network software, the installation of any network software (including UUCP and Micnet) violates C2 requirements.

#### 11.1 UUCP Example Changes

Some of the examples found in the UUCP documentation are misleading. In the "Complete UUCP Examples" section of Chapter 11 of the *System Administrator's Guide*, "Building a Remote Network with UUCP," the following corrections should be noted:

- All instances of NOLGIN in the */etc/passwd* entries are in reality asterisks, as can be seen in the */etc/passwd* file on your system.
- The examples all show a group ID (GID) of 4, which is actually 5.



- As shipped, the default entry for nuucp is as follows (it is broken into two lines to fit here):

```
nuucp:*:6:5:Anonymous UUCP site:
/usr/spool/uucplogins/nuucp:/usr/lib/uucp/uucico
```

Note that you should never edit */etc/passwd* with a text editor. The examples are shown for informational purposes; use the **sysadmsh Accounts→User→Create** or **Accounts→User→Modify** to set or change account parameters.

## 11.2 Changing the UUCP Sitename

In the same chapter noted in the previous section, the instructions on “Establishing the Sitename in the */etc/systemid* File” are incorrect. You are asked to set your sitename at installation time as described in “Setting Your Machine Name” in these *Release Notes*. Follow those instructions if you need to alter your sitename.

## 12. System Configuration and Link Kit Notes

The AT&T Link Kit has been adopted (with modifications) for this release. The user interface **configure**(ADM) has been preserved, with some additional options added. The new directory for the configuration files is */etc/conf*. The **master**(F) file is now obsolete and has been replaced by the **mtune**(F), **stune**(F), and **mdevice**(F) files. For more information, consult the “Adding Device Drivers with the Link Kit” in the *System Administrator's Guide*.

### 12.1 Streams Support

Streams runtime support is now provided with the operating system. However, Streams must be added to the kernel using the **mkdev streams** command.

### 12.2 Layers Support (Blit Terminals)

Blit terminals are supported with the **LAYERS** package and managed through the **xt**(HW) driver, which is not present in the kernel by default. To add the **xt**(HW) driver, you must edit the file */etc/conf/sdevice.d/xt* and change the “N” in the device entry to

## Operating System Release Notes

“Y” and relink the kernel. You must also create the necessary device nodes, as described in the *xt(HW)* manual page. In addition, entries in the */etc/inittab* and */etc/conf/cf.d/init.base* for the devices must be created.

### 12.3 10-bit I/O Addressing Check

The operating system detects machines that have only 10-bit I/O addressing. The message:

```
kernel: INFO: 10 bits of I/O address decoding
```

is displayed at boot time. Such machines cannot use serial boards strapped at addresses above 0x400. Serial boards must all be strapped below 0x400 on machines with only 10 bits of I/O address decoding.

### 12.4 idcheck(ADM)

The documentation for *idcheck(ADM)* is incorrect in the following respects:

- Page 2, under the **-a** option, the sentence: “The exit code is the addition of two different return codes” should read: “The exit code is based upon the first conflict found.” The phrases that follow it: “Add [1,2] to the exit code” should be: “The exit code is [1,2] if the IOA...”
- Page 2, under the description of the **-l** and **-u** options, the sentence: “The leading 0x is unnecessary” should read: “Do not enter the leading 0x when supplying the address.”

### 12.5 Kernel Operations

The following list describes important reminders and troubleshooting information for performing kernel procedures:

- The process accounting computation of a process's memory usage is incorrectly maintained. The value calculated for process memory usage is slightly less than the real result.

- When a program executes integer division by zero, the following error message is displayed:

floating exception - core dumped

This message does not accurately describe the error.

- Processes spawned by the kernel at boot time (**sched**, **/etc/init**, **vhand**, **bdf flush**) have start times (**STIME**), that is the time the system was last brought down, not the time they were spawned.
- Some core dumps may have possible file size errors reported by **fsck**, but these are only warnings and can be ignored. To determine whether the possible file size errors reported are resulting from core dumps, execute: **ncheck -i i-number** where *i-number* is given in the **fsck** message:

POSSIBLE FILE SIZE ERROR I=*i-number*

**ncheck** will generate the path name of a file from its inode number, *i-number*.

### 13. Internationalization

This section deals with internationalization issues.

#### 13.1 Internationalized Utilities

The **vi(C)**, **sh(C)** and **mail(C)** utilities have been modified to handle 8-bit characters.

#### 13.2 Documented Features not Present in this Release

##### 13.2.1 echo(C)

The 8-bit character option is not yet available.

## Operating System Release Notes

### 13.2.2 file(C)

The ability of to identify 8-bit text is not yet available.

### 13.2.3 more(C)

The -v option is not yet available.

### 13.2.4 grep, egrep, fgrep(C)

The -f option, which allows the reading of regular expressions from a file, is not included in this release.

### 13.3 Utilities Not Yet Internationalized

The following utilities are either partially internationalized or have not yet been modified. They will be completed in a later release.

at	echo	head	passwd	tr
authsh	ed	lc	pg	uugetty
awk	egrep	ln	pr	wall
cat	env	login	pwd	wc
cmp	ex	ls	rm	who
cp	exec	mail	rmdir	write
cpio	expr	micnet	sed	xbackup
cron	file	mkdir	sort	xdumpdir
dd	find	more	tail	xrestore
diff	finger	mv	tar	
dosutils	grep	ncheck	tee	

## 14. Compatibility and Conformance Notes

This section contains information about compatibility with other UNIX Operating System and XENIX releases and conformance to standards.



### 14.1 Security Standards Conformance

The security features present in this release are extensions to System V UNIX and are designed to meet the requirements of the "Class C2 Controlled Access Protection" rating as specified in the following security standards:

- DoD 5200.28-STD "Department of Defense Trusted Computer System Evaluation Criteria" (also known as the "Orange Book.")
- TD-85-02 Department of the Treasury Handbook for Automated Information Systems Security and Risk Management, April 1987.

Furthermore, password management facilities are present which meet the following standards:

- CSC-STD -002-85 "Department of Defense Password Management Guideline" (also known as the "Green Book.")
- FIPS PUB 112 Password Usage (a superset of the requirements described in the "Green Book.")

### 14.2 XENIX System V Compatibility

UNIX System V/386 Release 3.2 provides full binary and source code compatibility with applications developed for XENIX System V/386, XENIX System V/286, UNIX System V/386, and UNIX System V/286. This support does not extend to device drivers, however. The following list describes the level of XENIX System V support:

- Source code written for XENIX System V/386 programs and applications can be compiled and linked on UNIX System V/386 without having to modify the source code.

## Operating System Release Notes

- Binary applications developed for XENIX System V/386 (Release 2.2.0 and later), XENIX System V/286 (Release 2.0 and later) and XENIX System V/8086 (Release 2.0 and later) can be run on UNIX System V/386 without having to recompile the applications.
- The structure of the UNIX System V/386 file system allows both XENIX System V and UNIX System V binary applications to be executed. It also supports the mounting of a XENIX and UNIX removable file systems.
- Support for XENIX System call extensions enables programs to run as they did under the XENIX System.
- All device driver support routines available under XENIX System V/386 are available in UNIX System V/386.

### 14.2.1 System Calls that Differ in Release 3.2

The following XENIX System calls are supported in UNIX System V/386 Release 3.2, but function differently:

#### **ptrace()**

In Release 3.2, the **ptrace()** system call is not supported for XENIX System binaries. XENIX System binaries that rely on **ptrace** to work will not work on Release 3.2. To make their code run on Release 3.2, you will have to modify their XENIX System code to use the UNIX System version of **ptrace**.

#### **ulimit()**

XENIX System V/386 binaries that call **ulimit()** with the **cmd** argument set to 2, cannot increase their limit beyond the maximum number of blocks that are representable in a 512-byte block file system. This restriction is not enforced when the source is compiled on Release 3.2.

#### **uname()**

The **utsname** structure returned from **uname()** is a different size,

depending on whether you compile on XENIX System V/386 or on Release 3.2. On XENIX System V/386, there are extra fields at the end of the structure.

#### **14.2.2 XENIX-286 Application Execution**

This release of the UNIX System contains a XENIX System V/286 utility that allows XENIX System V/286 (Release 2.3.x) programs to run transparently on the Intel 80386 processor under UNIX System V/386 Release 3.2.

For more information about the XENIX-286 feature, see the `x286emul(C)` manual page in the *User's Reference*.

AT&T and XENIX conventions for device names are completely supported. The directories and naming schemes are discussed in the "UNIX Directories and Special Device Files" chapter of the *System Administrator's Guide*.

#### **14.3 AT&T SVID Conformance**

The AT&T SVID System V Interface Definition is a 3 volume set of books published by AT&T (select code 307-127). SCO UNIX System V has been tested against the AT&T SVVS3 tests, and the conformance has been verified.

#### **14.4 POSIX P1003 Conformance**

The referenced standard is published by the IEEE. SCO UNIX System V Release 3.2 conforms to the POSIX P1003.1 Operating System Interface Specification with only minor exceptions.

For a summary of implementation-defined behavior, consult the *Development System Release Notes*.

#### **14.5 FIPS PUB 151-1**

SCO UNIX System V/386 Release 3.2 substantially conforms to the FIPS PUB 151-1 requirements and future releases will be fully conformant.

## **Operating System Release Notes**

### **14.6 The ISO 8859 Character Set**

The operating system can handle all programs using the ISO 8859 character sets providing full 8 bit support and configurable for 7 and 8 bit peripherals with different character sets, including mapping files and conversion tools.

### **14.7 X/Open CAE Conformance**

The X/Open specification is defined in the X/Open Common Applications Environment (CAE) "X/Open Portability Guide," published by X/Open, Ltd. This specification includes systems and applications software, including languages and database systems. SCO offers a full X/Open CAE compatible product line. The Operating System portion is defined by the *X/Open Portability Guide*.

In addition, the XPG specifies 8-bit libraries and 8-bit versions of commands for the International market. These features have been added to the SCO UNIX System V/386 Operating System and Development System.



# **Appendix A**

## **Compatible Hardware**

### **Release 3.2.0**

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- A.A Compatible Hardware A-1
  - A.1 Using This Appendix A-2
  - A.2 Supported Hardware Configurations A-2
  - A.3 Standard Architecture 386-based Machines A-3
  - A.4 General Compatibility Guidelines A-5
    - A.4.1 Math Chips A-6
    - A.4.2 Memory Cards A-6
    - A.4.3 Multi-Function Cards A-8
    - A.4.4 Serial I/O Boards A-8
    - A.4.5 Tape Drives and Controllers A-10
    - A.4.6 Video Adapters and Monitors A-11
    - A.4.7 Add-On Hard Disks A-11
    - A.4.8 Compatible Hard Disk Controllers A-13
    - A.4.9 Mice and Other Graphic Input Devices A-13
    - A.4.10 Modems and Autodialing A-13
  - A.5 Standard Architecture Hardware Notes A-14
    - A.5.1 Memory Cards A-14
    - A.5.2 Serial Cards A-15
    - A.5.3 Add-On Hard Disks A-20
    - A.5.4 Compatible Hard Disk Controllers A-23
    - A.5.5 Video Cards A-23
    - A.5.6 Tape Drive/Controller Combinations A-26
    - A.5.7 Typical Device Interrupts A-29
    - A.5.8 Adaptec Host Adapter A-29
    - A.5.9 SCSI Guidelines A-32
    - A.5.10 ESDI Guidelines A-35
  - A.6 Microchannel Architecture Hardware Notes A-50

## Release Notes

- A.6.1 Math Chips A-50
- A.6.2 Serial Cards A-50
- A.6.3 Video Adapters and Monitors A-52
- A.6.4 Video Cards and Monitors A-52
- A.6.5 Compatible Hard Disk Controllers A-53
- A.6.6 Tape Drive/Controller Combinations A-53
- A.6.7 SCSI Guidelines A-54
- A.6.8 Configuration Warning A-56

## A.A Compatible Hardware

The SCO UNIX System V/386 Operating System Release 3.2 is available for many configurations of Personal Computer hardware, for both Industry Standard and Microchannel architectures. Your hardware configuration must have the original settings and boards before you install the Operating System. If you have added any boards, make sure that all switches are set as recommended in the manufacturer's hardware manual for that board.

This Appendix is divided into several sections. The first few sections list the supported machines by microprocessor and architecture type. "General Compatibility Guidelines" contains general guidelines for hardware compatibility that apply to both architectures.

The rest of the appendix is divided into the Standard Architecture and Microchannel Architecture Hardware Notes. Each covers specific configuration details, including charts of compatible peripherals, serial cards, video adapters monitors, hard disks and controllers. System parameters necessary for these devices also appear in this section. These guidelines must be followed to ensure proper system performance.

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### *Note*

The specific hardware that is listed in these *Release Notes* has been used with the UNIX System V/386 Operating System. However, because compatible machine or add-on peripheral manufacturers may change configuration, functionality, or firmware at any time, no guarantee is implied. Please write us with accurate hardware information for possible inclusion on our lists.

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## **Release Notes**

### **A.1 Using This Appendix**

To find a listing of compatible hardware for your machine, you must know your machine's classification. You must know the processor your machine uses and whether it uses Standard or Microchannel bus architecture. (Microchannel architecture refers to computers that are compatible with the IBM PS/2 computers.) You should also know if there are enhancements to your system, such as a non-ST506 AT disk controller. To find the available classifications of machines, check the section titled "Supported Hardware Configurations" that follows this introduction. Find your hardware configuration in the right hand column and match it with the corresponding version of SCO UNIX in the left hand column. There is a specific section of compatible hardware in this appendix for each version of SCO UNIX. There is also a section called "General Compatibility Guidelines" that discusses general compatibility issues with SCO UNIX. Read through this section before you install any extra hardware on your system.

### **A.2 Supported Hardware Configurations**

The UNIX System V/386 Operating System Release 3.2 works on standard 386-based personal computers, including those with support for Adaptec AHA-154x SCSI Host Adapter and SMS/OMTI 862x Direct ESDI disk controller.

Some computers arrive with the hard disk only partially formatted. If you have such a machine, use the MS-DOS hard disk format command or Diagnostics diskette to format the entire disk before installing the UNIX System V/386 Operating System.



## Appendix A

Some computers require specific switch settings to run the UNIX System V/386 Operating System. If your computer does not run the UNIX System V/386 Operating System with the settings as shipped, contact your computer hardware representative for the proper settings.

### A.3 Standard Architecture 386-based Machines

We have used the following machines under the SCO UNIX System V/386 Operating System:

- ALR FlexCache 20386
- ALR FlexCache 25386
- ALR FlexCache 33/386 Model 150
- Keen 2500
- Laguna Systems PDQ386
- Mitac 386
- ACER 1100/20
- ACER System 32/20
- AST Premium 386
- Cheetah CAT-386
- Corvus 331
- Compaq 386
- Compaq 386 33 Mhz
- Compaq Portable III 386
- Compaq DESKPRO 386/20
- Compaq DESKPRO 386/25
- Everex 386/20
- GRiDCase 1530
- Hertz 386/25
- Hewlett-Packard Vectra RS/16 PC
- Hewlett-Packard Vectra RS/20 PC
- Intel 302
- ITT 386
- Mitsubishi PC-386
- NCR 3386
- NCR 316
- NCR 316SX

## Release Notes

NEC BusinessMate 386  
NEC PowerMate 386  
Noble 386 from PC Discount  
Olivetti M380  
Olivetti M380 XP5  
Olivetti M380 XP7\*  
Olivetti M380 XP9\*  
PC Craft PCC 2400 386  
Tandy 4000  
Tatung TCS-8000 386  
Tatung TCS-8600 386  
Texas Instruments System 1300  
Toshiba T5100 386  
UNISYS PW2 Series 800/20  
Wang PC 380  
Wyse 386  
Zenith Z386

- \* On the XP7 and XP9, SCO UNIX System V/386 will not boot from the floppy drive if the Floppy Disk Access Speed Option is set in slow mode. The slow mode option is provided for the MS-DOS environment, and is not intended to be used in the UNIX environment. In order to successfully boot your UNIX system from the floppy disk, ensure that this option is set to fast mode.

The Intel Inboard in an IBM PC/AT or Intel-supported 286AT UNIX compatible is also supported.

The Orchid JET 386 in an IBM PC/AT or Orchid-supported 286AT UNIX compatible has also been reported to run UNIX 386.

The AOX Master 386 in an IBM PC/AT or AOX-supported 286AT UNIX compatible has also been reported to run UNIX 386.

## Appendix A

These machines have been reported to run SCO UNIX System V/386 Operating System, but we have not tested them:

Arnet Multiuser 386  
IBM PS/2 55 SX  
NCR PC916

Note that the personality card supplied by NCR must be configured so that the Video Adapter auto-switch feature is disabled.

### A.4 General Compatibility Guidelines

This section describes what hardware can be used with the standard UNIX Operating System Release 3.2 distribution. It contains hardware information that is generic to Standard and Microchannel Architectures. There are many other devices that you can use, which require additional vendor supplied software, that are available from independent hardware vendors. Call your dealer or SCO sales representative and ask for the third-party IHV/ISV catalogue.

If your computer is listed as a supported machine in this Appendix, it should run UNIX without adding any hardware or changing any jumper or switch settings. This appendix is provided as a reference so that you can check the compatibility of any piece of hardware you own or may wish to buy in the future.

---

#### *Note*

The machines supported are not always supplied with video cards by the same manufacturer. Please check the video card for compatibility.

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## **Release Notes**

### **A.4.1 Math Chips**

Your personal computer may include the 80387 math co-processor, which is automatically detected and supported by UNIX System V/386 Operating System Release 3.2. These co-processors will improve floating point efficiency.

Use math co-processors matching your machine's CPU speed. Follow the manufacturer's recommendations.

At boot time, the UNIX System V/386 Operating System announces the presence of a math co-processor if an 80387 is detected. Please note that switches on the main system board must be set properly to enable 80387 interrupts and/or your system must be set up with the manufacturer's setup disk to expect the chip. Insure that the system diagnostics recognize the co-processor presence and check your hardware manual for the proper switch settings.

Please note that on some motherboards, the operating system incorrectly recognizes the presence of an 80387 co-processor even if the chip is not installed. This problem is prevalent on machines that use the Intel motherboard. If your computer incorrectly recognizes the presence of an 80387 chip, make sure that blocks E48 and E49 are not connected with a jumper connection.

The Weitek 1167 numeric coprocessor is also supported.

Some 80387 exceptions have been masked. Refer to the manual page for 80387(HW).

### **A.4.2 Memory Cards**

In general, most memory cards work with UNIX. If you experience "panic: parity" errors it is often because of low quality memory chips or cards. This problem is especially prevalent with the 32-bit static RAM chips used in 386 machines.

With memory cards, check the switch settings on both the card and motherboard. Refer to the hardware manuals for your computer and for the memory card to find the correct switch settings. The UNIX System V/386 Operating Systems support up to 16MB of main memory.



### 32-bit Memory and 386 Machines

In the case of 386 machines, it is *strongly* recommended that you use 32-bit memory from your machine manufacturer. 16-bit memory is much slower, and may actually degrade overall machine performance. Several manufacturers have not resolved DMA issues relating to 16-bit memory, thus such machines will not recognize 16-bit memory (e.g. Zenith). When in doubt, consult the hardware manufacturer.

Most extended memory cards use 16-bit memory chips with a speed of about 150 ns. This memory is about 8 times as slow as static RAM, and so performance may be noticeably slower. We recommend using only 32-bit memory from your computer's manufacturer. If you must use 16-bit memory, at least use memory with fast (90ns) chips. In general, you must fully populate the memory board that comes with the machine with column static RAM chips, before you can add extended memory.

**REMEMBER:** Certain manufacturers reserve the upper 384K of the first megabyte for MS-DOS. On some machines, this "shadow" RAM cannot be accessed by UNIX. You must install additional memory in order to run UNIX.

If you see this message:

```
panic: memory failure -- parity error
```

Some part of your hardware is sending a "non-maskable interrupt" (a signal sent by the hardware that halts the operating system). You should run your system's hardware diagnostics tests if available. In addition, physically re-seat your memory cards and chips, and check for bent pins, etc. If these measures fail to correct the problem, or you don't feel comfortable in checking your hardware yourself, seek assistance from professional hardware experts. One frequent cause is memory chips that are slower than factory-recommended chips.

## Release Notes

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### *Note*

Memory parity errors seem to be much more prevalent with 32-bit memory, causing the system to panic. Replacing the defective memory is the only way to solve this problem.

---

### **A.4.3 Multi-Function Cards**

The serial ports on many multi-function cards function as expected if COM1 and COM2 are fully compatible with the standard specifications for these serial ports. These parameters are explained in the “Serial I/O Boards” section of these *Release Notes*.

Memory, parallel ports or other hardware will usually also function as expected.

### **A.4.4 Serial I/O Boards**

This section describes the conditions and results of using various serial I/O boards with the UNIX System V/386 Operating System. Standard single port serial I/O boards function as expected if COM1 and COM2 are fully compatible with the standard specifications for these serial ports.

To configure the Operating System for the serial board you are installing, you must run the **mkdev serial** command. See the “Using Bus Cards” and “Adding, Ports, Terminals and Modems” chapters of the *UNIX System Administrator's Guide* for more information on **mkdev serial**.

---

### Note

If you are installing an Arnet Smartport card, do not use **mkdev serial** to configure your card. Arnet provides configuration software that is **custom(ADM)**-installable. Consult your Arnet documentation for additional information.

---

Each multiport serial I/O board is unique; the UNIX System V/386 Operating System has special driver code for each card listed. Only those with status poll registers can work with the high performance driver scheme chosen, and new boards require additional driver support.

Refer to the **serial(HW)** and **mkdev(ADM)** manual pages for more information on compatible serial I/O cards and on adding and enabling serial lines.

### Serial I/O Chip Notes

Some computers or add-on serial I/O cards use the 8250a serial I/O chip. (16450 chips are strongly recommended for 386 machines.) Some revisions of this chip do not handle interrupts properly. MS-DOS does not use interrupts, so the use of this chip with MS-DOS causes no problems. The UNIX System V/386 Operating System does make use of interrupts, as it is a multi-tasking operating system.

The problem with the serial I/O chip shows up when using **uucp(C)** or **cu(C)**. Indications that your computer contains a bad revision 8250a chip are that **uucp(C)** may lose characters constantly and generate unkillable **uucico** processes, and that **cu(C)** at high baud rates stops executing and does not exit.

## Release Notes

The problem rarely shows up when using the serial port with a terminal. It is associated with high-speed serial input. If you want to use **uucp(C)** or **cu(C)** and your computer has one of these chips, we recommend you replace the 8250a chip with an 8250b serial I/O chip or use a multi-function card containing a serial port and configure it as COM1 or COM2. Disable the built-in serial port or avoid high-speed input on that port.

All COM1 boards should be strapped at interrupt vector 4. All COM2 boards should be strapped at interrupt vector 3. Check your serial card hardware manual or call the hardware manufacturer for the switch settings that implement these addresses.

---

### Note

SCO uniPATH SNA-3270 uses interrupt vector 3, which can interfere with the use of a serial card on COM2.

---

### A.4.5 Tape Drives and Controllers

Refer to "Using a Cartridge Tape Drive" in the "Using Storage Media" chapter of the *Unix System Administrator's Guide* for more information on the Irwin drive.

Note that these drives are sometimes sold under other brand names. Only one cartridge tape subsystem is supported per computer. (It is possible to have one cartridge tape drive plus a mini-cartridge or QIC-40 drive configured on a system.) This limit does not apply to SCSI tape devices. QIC-24 format is supported on the full size cartridges. Tape support is raw (character) only, no block device. A no-rewind device exists for writing multiple tape files on a single tape. A tape utility, **tape(C)**, is provided for rewinding, erasing, format, retensioning, etc.



To configure your system for a tape unit, run **mkdev tape**. If you do not choose specific values for the DMA channel, interrupt, and base address, the default values will be used. (This information is found in "Tape Drive/Controller Combinations" of these *Release Notes* in the section that applies to your machine architecture.) Note that most addresses are specified in hexadecimal. If you do not use the default settings, watch for possible interrupt conflicts with other installed devices. The "Tape Drive/Controller Combinations" section indicates what interrupts may be in use on your system. You should not use interrupts 0, 1, or 6, as these are already in use regardless of additional devices. The **mkdev tape** menu indicates the Irwin units as "Mini-Cartridge," and all other units are indicated as "Cartridge," "QIC-40," and "SCSI" units. The Irwin units are not configurable.

### A.4.6 Video Adapters and Monitors

Any video adapter/monitor combination which runs with an adapter that is a true equivalent of a standard adapter should run under the UNIX System V/386 Operating System.

The UNIX System V/386 Operating System supports the use of two video adapters and two monitors, one of type mono and the other of type color. Use of only a single VGA adapter is supported.

Adapters which come as the default adapter in supported computers (monochrome or color monitor) will work with the UNIX System V/386 Operating System.

### A.4.7 Add-On Hard Disks

Many hard disks, both standard and nonstandard, can be used by the UNIX System V/386 Operating System as long as the disk controller supports the drive. The disk must interface electrically with the disk controller (usually "ST506"). Controllers supporting other drive interfaces such as RLL or ESDI will work as long as the controller presents a compatible interface to the bus.

MS-DOS generally does not support non-standard disks (i.e. those not defined in the ROM Fixed Disk BIOS).

## Release Notes

Some hard disks come from the factory only partially formatted (e.g. the Maxtor 1140 140MB). This problem may become evident during installation, when **badtrk**(ADM) indicates that every sector past a certain cylinder/head location is bad. You should contact the manufacturer to determine whether or not the disk is completely formatted. There are several products available that will format hard disks.

Compatible hard disk controllers are discussed in the next section.

**For a standard disk:** the motherboard ROM must have an entry for the disk (*type*) determined by the number of heads, cylinders, tracks per cylinder (heads), sectors per track, and other characteristic information.

Follow the manufacturer's instructions to set switches or configuration.

**For nonstandard disks:** the user may type in information that overrides the ROM disk configuration information during installation.

If you are unsure of what parameters to enter for your non-standard disk, contact your disk manufacturer for this information. The **dkinit** program (called during installation) uses parameters as defined in the "Fixed Disk BIOS Parameter Table" in Section 5 of the IBM Technical Reference (AT).

SCO supports UNIX on hard disks with up to the 1024 cylinders only. Some hard disks have more than 1024 cylinders. Due to the non-standard nature of the hard disk controllers that support disks with more than 1024 cylinders, and due to the need for MS-DOS co-residency, SCO does not support UNIX on these disks. However, UNIX has been reported to work on disks with more than 1024 cylinders. For example, with the DPT PM3011 controller, UNIX works with disks containing 2048 cylinders, 16 heads, and 63 sectors, for a total maximum disk capacity of 1 gigabyte.

### A.4.8 Compatible Hard Disk Controllers

Many hard disks will work with the UNIX System V/386 Operating System. Whether or not a disk works depends upon the controller board. Here are two tests the controller must meet:

1. The disk controller is fully compatible with the standard controller for that configuration.
2. No special vendor software is needed to make the controller work under MS-DOS.

If a controller meets these tests, it should work, but if it fails these tests, it will not work.

### A.4.9 Mice and Other Graphic Input Devices

The following graphic input devices are supported:

- Logitech Serial Mouse
- Microsoft Serial Mouse
- Mouse Systems PC Mouse
- Mouse Systems PC Mouse II\*
- Microsoft Busmouse or InPort Bus Mouse
- Logitech Bus Mouse
- Olivetti Bus Mouse
- IBM Personal System/2 Mouse
- Summagraphics Bitpad

- \* The Mouse Systems PC Mouse II is an optical mouse. You must use it in Microsoft Serial Mouse emulation mode and add it to the system as a Microsoft Serial Mouse.

### A.4.10 Modems and Autodialing

Any 100% Hayes-compatible modem works using **uucp(C)** and **cu(C)**. The default autodialer is for the Hayes Smartmodem 1200. We strongly recommend external modems. An autodial program is also supplied for the Racal Vadec 3451, the 212, and the Hayes Smartmodem 2400. Other autodialing modems can be supported by writing a dialer program, or modifying the existing one in */usr/lib/uucp/dial*.

## **Release Notes**

In addition, the new Honey DanBer UUCP package includes a large number of dialers in the *Dialers* file.

See the "Building a Remote Network with UUCP" chapter of the *System Administrator's Guide* for more information on writing other dialer programs.

### **A.5 Standard Architecture Hardware Notes**

The following sections explain what hardware can be used with 386 machines based on Standard Architecture.

#### **A.5.1 Memory Cards**

We have used the following memory cards:

AMI SMART PACK 2

AST

JustRAM/AT 8MB Card (Monolithic Systems)

Quadram

Tecmar

Talltree Systems

Silicon Valley Systems

STB Rio Grande

Micron Chessmate



### A.5.2 Serial Cards

The following serial I/O boards are supported by the UNIX System V/386 Operating System for Standard Computers:

- AMI lamb 4 and 8 port
- Arnet Controls 2, 4 and 8 port (clock option not supported)
- Arnet Twin port
- AST FourPORT/XN
- Control Systems Hostess 4 and 8 port versions
- CTC Versanet 4AT (4 port) and 8AT (8 port)
- Digiboard 4 and 8 port
- IBM standard COM1 and COM2
- Kimtron Quartet 4 port\*
- Olivetti RS232C Multiport Board
- Quadram QuadPort™
- Stargate Technologies OC4400 (4 port) and  
OC8000 (8 port) versions
- Tandon Quad Serial Card
- UNISYS 4 port

\* The Kimtron board does not work with all 386 machines.

It is also strongly recommended that multiport cards utilize 16450 serial I/O chips instead of the slower 8250 chips. If you see a "double echo" problem, particularly on multiport cards, it is due to slow serial I/O hardware.

## Release Notes

### Serial Card Addresses and Notes

Serial Card Addresses						
Physical Port	Board Type	Number of ports	Primary Address Range	Alternate Address Range	Primary Status Address	Alternate Status Address
COM1	AMI lamb**	8	0x540-0x17F	n/a	0x210	n/a
	AMI lamb**	4	0x540-0x15F	n/a	0x210	n/a
	Arnet	8	0x100-0x13F	0x280-0x2BF	0x142	0x2C2
	Arnet	4	0x100-0x11F	0x280-0x29F	0x142	0x2C2
	Arnet	2	0x100-0x10F	0x280-0x28F	0x142	0x2C2
	AST*	4	0x2A0-0x2BF	n/a	0x28F	n/a
	CTC†	8	0x160-0x19F	n/a	n/a	n/a
	CTC†	4	0x160-0x17F	n/a	n/a	n/a
	Digiboard††	8	0x110-0x14F	n/a	0x151	n/a
	Digiboard††	4	0x110-0x12F	n/a	0x151	n/a
	Hostess	8	0x140-0x13F	0x500-0x2BF	0x680	n/a
	Hostess	4	0x140-0x11F	0x680-0x29F	0x700	n/a
	Kimtron	4	0x120-0x13F	n/a	0x8120	n/a
	Olivetti†††	4	0x2A0-0x2BF	n/a	0x2BF	n/a
	Quadram***	5	0x280-0x2CF	n/a	0x2D3	n/a
	Quadram***	1	0x280-0x28F	n/a	0x2D3	n/a
	Stargate	8	0x290-0x2CF	n/a	0x2D0	n/a
	Stargate	4	0x290-0x2AF	n/a	0x2D0	n/a
	Tandon***	4	0x2A0-0x2BF	n/a	n/a	n/a
COM2	AMI lamb**	8	0x2C0-0x2FF	n/a	0x212	n/a
	AMI lamb**	4	0x2C0-0x2DF	n/a	0x212	n/a
	Arnet	8	0x180-0x1BF	0x300-0x33F	0x1C2	0x342
	Arnet	4	0x180-0x19F	0x300-0x31F	0x1C2	0x342
	Arnet	2	0x180-0x18F	0x300-0x30F	0x1C2	0x342
	AST*	4	0x1A0-0x1BF	n/a	0x1BF	n/a
	CTC†	8	0x218-0x257	n/a	n/a	n/a
	CTC†	4	0x218-0x237	n/a	n/a	n/a
	Digiboard††	8	0x210-0x24F	n/a	0x250	n/a
	Digiboard††	4	0x210-0x22F	n/a	0x250	n/a
	Hostess	8	0x200-0x1BF	0x580-0x33F	0x587	0x707
	Hostess	4	0x200-0x19F	0x700-0x31F	0x587	0x707
	Kimtron	4	0x2E0-0x2FF	n/a	0x82E0	n/a
	Olivetti†††	4	0x1A0-0x1BF	n/a	0x1BF	n/a
	Quadram***	5	0x288-0x2D7	n/a	0x2DB	n/a
	Quadram***	1	0x288-0x297	n/a	0x2DB	n/a
	Stargate	8	0x190-0x1CF	n/a	0x1D0	n/a
	Stargate	4	0x190-0x1AF	n/a	0x1D0	n/a
	Tandon***	4	0x280-0x29F	n/a	n/a	n/a
OTHER1	UNISYS****	4	0x000-0x03F	n/a	n/a	n/a
OTHER2	UNISYS****	4	0x008-0x047	n/a	n/a	n/a

\* Only enhanced mode is supported. Do not use the AST driver.

## Appendix A

**\*\*** Only continuous mode is supported.

**\*\*\*** Tandon is the only card whose I/O addresses are potentially identical with other supported cards, such as the AST and Quadram serial cards.

Since card addresses must not overlap in the same systems, if you have both a Tandon and a Quadram, the Tandon must be on COM1 and the Quadram must be on COM2.

You can use the following Quadram serial expansion cards in these configurations under the standard UNIX Operating System:

COM1	COM2
5-port	-
1-port	-
-	5-port
-	1-port
5-port	1-port

If you need to use any other configuration of Quadram cards, you must relink the kernel using the Link Kit. You also need to edit */etc/conf/pack.d/sio/space.c* as follows:

1. This file contains several groupings of serial card descriptions. Each group is identified by the first number on the description line.

Find the descriptions for the Quadram cards in each group and move that descriptor line to the front of the group.

2. Remake and boot the new kernel. Refer to "Adding Device Drivers with the Link Kit" in the *System Administrator's Guide* for information on the Link Kit.

## Release Notes

\*\*\*\* These serial cards only work on the UNISYS PC/IT.

† Notes for the CTC Versanet serial cards:

1. The correct switch settings for the 8AT and 4AT are:

As a COM1 ( strapped at addr 0x160, using irq4 )  
the 8AT has:

switches 33, 35, 36, 38, 39 & 40 OFF  
switches 34, 37 ON (i.e.: shunted)

on the DIPSWITCH selection:

5, 6 & 8 should be OFF  
all the others should be ON

As a COM2 ( strapped at addr 0x218, using irq3 )  
the 8AT has:

switches 33, 35-40 OFF  
switch 34 ON (i.e.: shunted)

on the DIPSWITCH selection:

1, 2 & 7 should be OFF  
all the others should be ON.

The 4AT is the same as the 8AT in both the above  
cases, with the following common exception:

switches 39 & 40 MUST BE ON (shunted)

2. These boards come in both 8250 and 16450 versions. You must have the 16450 version if you intend to run on 386. The 8250 should run on the 286.



## Appendix A

3. The original CTC Versanet boards used different addresses. Please ask your hardware vendor for versanet boards strapping at the above addresses (0x160 and 0x218).
4. The CTC "Maomao-4" serial board is not supported.

### †† Notes on the Digiboard serial card:

1. Ports for switches DS2 to DS5 (DS9 for 8 port version) must be strapped starting at the boards base address as given in the table and incrementing by 8 for each port.

The following example is for COM1 at 110:

DS2	110
DS3	118
DS4	120
DS5	128
DS6	130
DS7	138
DS8	140
DS9	148
DS1	150

2. If COM1 is used, then all the ports must be strapped as "EVEN" to interrupt request line 4 (see Digiboard documentation). If COM2 is used, then all the ports must be strapped as "ODD" to interrupt request line 3 (same notation).
3. Only rev. 3 and later boards are supported.

## Release Notes

### ††† Notes for the Olivetti RS232C Multiport board:

1. The factory settings will not function properly - you must alter the existing switch positions to reflect those listed in Item 4 below.
2. If you are using a single Olivetti board, you must configure it as COM2.
3. If you are using two Olivetti boards, one must be configured as COM2 and the other configured as COM1, with the COM1 port built into the M380 disabled. To disable the COM1 port built into the M380, refer to the section on "Setting Up the System" in your Olivetti *Installation and Operations Guide*.
4. The correct switch settings:

As a COM1 (strapped at addr 0x2A0):

IRQ2	IRQ3	IRQ4	IRQ5	IRQ6	IRQ7	XA1	XA0	INT	SHR
off	off	on	off	off	off	off	on	on	off

As a COM2 (strapped at addr 0x1A0):

IRQ2	IRQ3	IRQ4	IRQ5	IRQ6	IRQ7	XA1	XA0	INT	SHR
off	on	off	off	off	off	off	off	on	off

### A.5.3 Add-On Hard Disks

Many hard disks can be used as long as the motherboard supports the drive, or the ROM parameters are entered at installation time. ROM entries for the IBM PC AT are listed here. Refer to your computer hardware manual for the disk types supported by other computers.

## Appendix A

IBM PC AT Disk Types Entries on Motherboard ROM			
Type	Cyls.	Hds.	Size
1	306	4	10 MB
2	615	4	20 MB
3	615	6	30 MB
4	940	8	60 MB
5	940	6	45 MB
6	615	4	20 MB
7	462	8	30 MB
8	733	5	30 MB
9	900	15	110 MB
10	820	3	20 MB
11	855	5	35 MB
12	855	7	50 MB
13	306	8	20 MB
14	733	7	40 MB
15	0	0	Reserved
16	612	4	20 MB
17	977	5	40 MB
18	977	7	55 MB
19	1024	7	60 MB
20	733	5	30 MB
21	733	7	40 MB
22	733	5	30 MB
23	306	4	10 MB

no precompensation

Note that other compatible machines often have different ROM tables. Check your computer hardware reference manual for the appropriate ROM table entries for your computer.

The following hard disk drives have been tested and found to work correctly with SCO UNIX System V/386 Operating System:

## Release Notes

CDC Wren IV  
CDC Wren V  
Conner CP-340  
Conner CP-3100  
Quantum Q250  
Quantum Q280  
Quantum P40S  
Quantum P80S  
Syquest SQ555

The following hard disk drives are reported to work with UNIX 386GT:

Maxtor XT-4380S  
Maxtor LXT-100S

For disks using the Adaptec AHA-154x controller, the first disk drive (ID-0:LUN-0) should have no jumpers on A0, A1 and A2. The second disk drive (ID-1:LUN-0) should have a jumper on A0 and no jumpers on A1 and A2.



## Appendix A

### A.5.4 Compatible Hard Disk Controllers

We have used the following controllers on the SCO UNIX System V/386 Operating System Release 3.2:

- Adaptec ACB-2320
- Adaptec ACB-2322\*
- Adaptec ACB-2370 RLL
- Adaptec ACB-2372 RLL\*
- Adaptec AHA-154x SCSI Host Adapter
- SMS OMTI 8620 (ESDI controller)
- SMS OMTI 8627 (ESDI controller)
- Western Digital WD1010 or compatible
- Western Digital WD 1003\*\*
- Western Digital WD 1003-WA2\*\*
- Western Digital WD 1005
- Western Digital WD 1007
- DPT PM3011\*\*\*
- DPT MX3011\*\*\*
- DTC WD1010 compatible
- DTC WD2010 compatible

\* These models are hard disk and floppy disk controllers.

\*\* The Western Digital controller cards use either WD1010, WD2010, or WD2020 controller chips.

\*\*\* The DPT controller cards must have EPROM 2E or later to run UNIX on a Compaq.

### A.5.5 Video Cards

We have used the following video adapters and monitors under the SCO UNIX System V/386 Operating System Release 3.2. Although many standard emulating cards work, these are some specific examples.

## Release Notes

Video Cards and Monitors	
Card	Monitor
<b>Mono</b>	
IBM Mono Card	standard monochrome
Hercules mono	WY-530 (monochrome)
Hercules+ mono (text mode only)	AST mono
Persyst mono	Basic Time
<b>CGA</b>	
IBM CGA	standard RGB (red green blue) or composite color
Paradise Modular Graphics Card	Wyse WY-630 (color)
Everex Graphics Edge	
AST CGA	
Olivetti CGA	
Plantronics Color-Plus	Wyse 700 (in CGA mode, 80x25 text only)
<b>EGA</b>	
IBM EGA	IBM EGA
	standard RGB color
	standard monochrome
	Multisync
Compaq EGA	
Tandy EGA	
ATI EGA Wondercard* (EGA only)	
Olivetti OEC	
AST 3G	
Wyse WY-440 (EGA card)	WY-640 (color EGA)
NEC APC-H431	
<b>VGA</b>	
IBM VGA	Model 8503(mono)
	Model 8512(color)
	Model 8513(color)
	Model 8514(color)
Compaq Diamond	Compaq mono VGA
	Compaq color VGA
HP Video Graphics Adaptor	HP Video Graphics Color Display
VEGA Video 7 (in VGA mode)	
Olivetti OVC	
Paradise VGA	
Wyse VGA†	
Tandy VGA	

\* EGA Wondercard Advanced Features Switch (DIP switch 8) must be OFF

† CGA-emulation mode is not supported.

### **Compaq Display Adapter Note**

CMOS location 0x2d is read at boot time to initialize the display adapter. If that register is non-zero, the adapter will be initialized in a manner specific to the Compaq VDV. Be sure CMOS location 0x2d is set to zero unless you are using a Compaq VDV.

### **Wyse WY-700 High Resolution Mono Monitor.**

There is a known problem with the screen display going blank temporarily. This can occur on any Wyse pc286, IBM PC/AT, or AT compatible with this monitor installed. This problem occurs with REV D of the WY-700 mother and/or daughter board. See ASSY # on lower left edge of board for REV level. You should replace the board with a more recent revision; request return merchandise authorization (RMA) from Wyse Technology.

### **External RGB Monitor on Compaq Portables.**

The external RGB monitor is supported on Compaq portable III systems via the **vidi internal** and **vidi external** commands.

VGA cards that have alternate modes (EGA or CGA mode) only work in VGA mode.

The Tandy DDGA model 25-3047 video card runs correctly in this release. The following Video Adapters are supported in 386GT:

- Tandy 3045A DDGA
- Tandy 4037 EGA

The following Monitors are supported in 386GT:

- Tandy 3011 VM-5 Monitor
- Tandy 1020 VM-4 Monitor
- Tandy 1043 CM-5 Monitor
- Tandy 1024 CM-11 Monitor
- Tandy 4035 EGM-1 Monitor

## Release Notes

### A.5.6 Tape Drive/Controller Combinations

The tape driver included in this release work with the following drive/controller combinations:

#### Supported QIC-02 Tape Controllers and Cartridge Drives

Manufacturer	Controller	Drive	Type	Notes
Archive	SC400	Scorpion 5945	A	
Archive	SC402	Viper QIC-02/60MB	A	(4,5)
Archive	SC402	Viper QIC-02/150MB	A	(4,5)
Archive	SC499r	Scorpion 5945	A	
Computone	SC400	Scorpion 5945/60MB	A	
TI	SC400	Scorpion 5945/60MB	A	
ITT	PC-36	5000(E)	W	
COREtape	PC-36	5000(E)	W	
Olivetti	PC-36	5000(E)	W	(1)
Wangtek	PC-36	5000(E)	W	
Wangtek	PC-36	5xxxPK/125,150MB	W	
Wangtek	PC-36	5xxxEK/60,125,150MB	W	
Tecmar	PC-36	QIC-60AT	T	
Tecmar	PC-36	QT-60I	T	
Tecmar	PC-36	QT-90I	T	
Tecmar	PC-36	QT-125I	T	
Tecmar	PC-36	QT-150I	T	
Tecmar	PC Bus Host Adapter	QT-60E	T	
Tecmar	PC Bus Host Adapter	QT-90E	T	
Tecmar	PC Bus Host Adapter	QT-122E	T	
Tecmar	PC Bus Host Adapter	QT-150E	T	
Emerald	xnx-50-2012	Cassette	E	(3)
Emerald	xnx-60-2002	Cartridge	E	(3)
Cipher	QIC-02	CP-60B	W	



## Appendix A

Cipher	QIC-02	CP-125B	W	
Cipher 5400/plus	Cipher 811/817		E	
Mountain	QIC-02	60MB Filesafe	M	
Mountain	QIC-02	150MB Filesafe	M	(5)
Mountain	QIC-02	300MB Filesafe	M	(5,6)
Mountain	PC-36	60MB Internal	W	
Mountain	PC-36	150MB Internal		(5)
Everex	PC-36	60MB Internal	X	
Bell Technologies	PC-36	XTC-60	W	

Most controllers that conform to the QIC-02 standard will work with this release, but only the units listed have been tested.

In addition, the following floppy drive/controller combinations are supported:

### Supported Floppy Tape Controllers and Cartridge Drives

Manufacturer	Drive	Notes
Alloy	APT-40/Q (40MB)	
Irwin	110 (10MB)	(2,3)
Irwin	125 (20MB)	(2,3)
Irwin	145 (40MB)	(2,3)
Irwin	185 (80MB)	(2,3)
Irwin	225 (20MB)	(2,3)
Irwin	245 (40MB)	(2,3)
Irwin	285 (80MB)	(2,3)
Irwin	2020 (20MB)	(2,3)
Irwin	2040 (40MB)	(2,3)
Irwin	2080 (80MB)	(2,3)
Mountain	TD44-40 (40MB)	
Wangtek	FAD 3500 (40MB)	
Tecmar	QT-40i (40MB)	

## Release Notes

### Default Settings

Manufacturer	Base Address	DMA Channel	Interrupt	Type
Computone	0x200	1	4	A
Archive	0x220	3	3	A
TI	0x220	3	3	A
Mountain	0x28C	1	3	M
Everex	0x2C0	1	5	X
Compaq	0x300	1	5	W
Emerald	0x300	3	25	E
Tecmar	0x330	1	5	T
Wangtek	0x338	1	5	W
ITT	0x338	1	5	W

### Supported SCSI Tapes Drives

Manufacturer	Drive	Notes
Archive	60/150MB	(5)

### Notes

1. The Olivetti tape controller's factory jumper settings do not match the type W drive default values. To use the Olivetti drive without changing the controller card's jumper settings, use the **mkdev tape** command to select all four of the following settings:

Type	DMA	Interrupt	Base Address (hex)
W	1	25	0x288

2. The Irwin 40-megabyte drive can use either DC2000 or DC1000 tape cartridges and the 10- and 20-megabyte drives use a DC1000 tape cartridge. A DC1000 tape written on a 125 or 145 model drive can be read by either drive.

## Appendix A

3. Irwin and Emerald drives now function properly on 20MHz 386 machines.
4. Archive drives using the SC402 controller do not use the default type A interrupt 4. Use the **mkdev tape** command to change the interrupt or restrap the controller card.
5. High-density 150-megabyte drives require DC6150 or DC600XTD tapes for writing. Low density tapes can be read but not written.
6. External unit has two tape slots, each with 150MB capacity, giving this tape drive unit a 300MB capacity.

### A.5.7 Typical Device Interrupts

Interrupt	Device
0*	Clock
1*	Console
2	Networks and others
3	Serial COM2
4	Serial COM1
5	Alternate Parallel Port (lp2)
6*	Floppy Disk
7	Main Parallel Port (lp0 or lp1)

\*Do not use these interrupts.

### A.5.8 Adaptec Host Adapter

This section describes the Adaptec AHA-154X host adapter. Use this information as a model for understanding how a host adapter operates.

The Adaptec AHA-154X host adapter is the currently supported SCSI host adapter in the System V operating system kernel.

## Release Notes

The 154X host adapter supports first party DMA, asynchronous and synchronous peripherals, jumper selectable DMA and interrupt channels and I/O port addresses, programmable mailbox architecture that allows multithreaded operation on the SCSI bus, and even or odd starting address transfers.

The SCSI software supports only the Adaptec 154X SCSI host adapter family. The AHA-154X back-end software allows setting of 154X adapter-configurable parameters. Some of the possible settings are:

- Bus on-time
- Bus off-time
- Transfer rate
- Number of CCBs
- Number of mailboxes

The SCSI software provided in the development system contains initial support for up to two Adaptec AHA-154X host adapters and the following disk and tape devices:

- Adaptec 4525 SCSI ESDI Disk Controller
- Archive Viper Tape Drive series
- CDC Wren IV Disks
- Cipher 60Mb, 125Mb Tape Drives
- Quantum Q200 series Disks
- Quantum PRO series Disks
- Syquest SQ-555 Removable Disks



### Mailboxes

The Adaptec 154X host adapter utilizes an outgoing and incoming mailbox architecture for task communication between itself and the host. This allows the host adapter to do all the SCSI handshaking, making the software driver simpler to write and maintain.

At system initialization, the adapter driver initializes the location and size (number) of the mailbox structure in system memory, and relays this information to the host adapter. Outgoing mailboxes consist of one command byte and three bytes that point to a command control block, or CCB, associated with a particular task. The mailbox is free if the command byte is zero. Incoming mailboxes are located immediately after the outgoing mailboxes in local memory and are made up one byte of status (of the completed task) and three bytes that, again, point to the CCB of that task. If the status byte is zero the incoming mailbox is free for use.

### CCBs

The command control block contains the SCSI command descriptor block. A control block is provided for each of the three different lengths of commands, six bytes, ten bytes, and twelve bytes. Note that the conversion routines described on the *scsi(K)* manual page are used for data of differing lengths. The CCB is defined in *sys/adaptec.h*.

### Task Queueing

To queue a task, the host builds a CCB and stores its memory location into a free mailbox. The host writes a non-zero command byte to the mailbox and then issues a request to the adapter to scan the outgoing mailbox structure. After the adapter finds the full mailbox, it copies the contents into its internal buffer and writes a zero to the command byte of the mailbox, thus freeing the mailbox for another task.

At task completion, after the host adapter finds an empty mailbox in the incoming mailbox buffer, it updates the mailbox with the task's completion status and CCB pointer. An interrupt is generated to inform the host of the task's completion. Since the adapter fills

## Release Notes

the incoming mailbox area in a round-robin fashion, the host can keep track of where the last completed task was stored and can find the current task status immediately. After finding the completed task's mailbox, the host writes a zero into the status byte, thereby freeing the mailbox.

### A.5.9 SCSI Guidelines

The SCSI bus consists of a 50 conductor flat cable which connects SCSI devices together in a daisy chained configuration. There are two types of devices that can be hooked onto the SCSI bus: host adapters and controllers. The host adapter is a card that plugs into the computer. Controllers are used to connect different kinds of SCSI devices to the SCSI bus.

The 50 conductor flat cable has a minimum of two connectors and a maximum of eight. This cable can be up to 20 feet long. Care should be taken to insure that the connectors are plugged into the 50-pin sockets in the correct direction. No electrical damage will result from incorrect orientation, but none of the devices on the bus will work.

The SCSI bus needs electrical termination at both ends of the cable. Host adapters and controllers normally have termination capability built onto their circuit boards. Setting termination on usually involves inserting or removing several resistor-packs from the circuit board, although this can vary from manufacturer to manufacturer. The AHA-154x is shipped from the factory with termination set on.

If you accidentally terminate a device in the middle of the bus (i.e. not on the end of the cable), the remaining SCSI devices "below" the terminated device will not work. To fix the problem, simply move the termination to the last device on the cable.

This release of the Operating System supports up to two AHA-154x Host Adapters. However, only one adapter can be used to support hard disks (limit 4). Tape drives will work on the second adapter, however.

## Appendix A

The Adaptec SCSI host adapter should run correctly with the manufacturer's default settings. It should be configured at base address 0x330, IRQ 11, and DMA channel 5. However, on some computers, such as the Tandy 4000, you must remove jumper J5 if the host adapter is an AHA-1540 or 1540a, or jumper J8 if the host adapter is an AHA-1542. (For more information, refer to your Adaptec documentation.)

If you are installing a second Adaptec AHA-1540 board, you must reset several jumpers to be configured at base address 0x230, IRQ 12, and DMA channel 6. Some computers, such as the Tandy 4000, require you to remove jumper J8. For two AHA adapters to coexist, the BIOS must be disabled on the second adapter. This can be done with the newer AHA boards (1540a/1542a) by removing a jumper, but not with the older 1540 boards. You will not be able to use two 1540 boards in one machine. (For more information, refer to your Adaptec documentation.)

Not all manufacturer's computer systems are compatible with the Adaptec host adapters. If you are unable to get the host adapter to function or experience file corruption, please contact your manufacturer or Adaptec to determine if your hardware is incompatible.

Each device on the SCSI bus must have an address. The address has two components: an address for the controller and an address for the device itself. The device address is known as a logical unit address (LUN). In this release, the first SCSI disk must be configured as ID-0:LUN-0 (controller address 0, device address 0). The ID number corresponds to the jumper or switch settings on the disk, so care must be taken that hard disk settings are correct. Additional disks may be any other ID between 1-7. Note that the Host Adapter uses one of the ID numbers (typically number 7). The LUN number must always be 0.



## Release Notes

If your system has only SCSI disks installed, the “setup” program must be instructed “no hard disks installed.”

If you have both ST506 and SCSI disks installed on your computer, UNIX must be installed on an ST506 disk, using it as the root disk. This implies that if you currently have UNIX installed on a SCSI disk and you want to add an ST506 disk, you must reinstall UNIX using the ST506 as the root disk. SCSI disks installed,

On a system with both ST506 and SCSI disks, four ST506 disks are supported.

Up to four SCSI tape drives are supported on a SCSI bus. SCSI tape drives can be configured at any ID on either Host Adapter.

---

### Note

150 Mbyte and 120 Mbyte tape drives can generally read 60 Mbyte tapes but not write them.

---

Use **mkdev hd** to add more drives to the system, regardless of whether they are SCSI or WD controlled. Use **mkdev tape** to add a tapedrive to the system, SCSI or any other type.

### Formatting a SCSI Disk

If you need to format a SCSI secondary disk after installing UNIX on the primary disk, you must use the **adfmt** command.

To format a SCSI disk, do the following:

1. Run **mkdev hd**; choose the SCSI option, and supply the the ID, Host Adapter, and LUN. Reconfigure the kernel and reboot.
2. Determine correct device number by either:



- (a) Run the following command:

```
ls /dev/rdsk/*
```

The hard disk entry with the largest number (example, */dev/rdsk/1s0* or */dev/rdsk/2s0*) is the device you should use.

- (b) Run the following command:

```
more /usr/lib/mkdev/perms/HD.
```

The last group of entries refer to the new device.

3. Run the following command:

```
adfmt /dev/rdsk/ns0
```

Where *n* is the number noted previously.

This causes the secondary disk to be formatted. Note that **adfmt** is only used with SCSI disks. Also note that SCSI disks do not normally need to be formatted.

### A.5.10 ESDI Guidelines

You must know what BIOS is in use on your controller card before you install the disk system. To check your BIOS type, find the BIOS chip on the controller card. Most manufacturer's BIOS chips are found near the bus connectors in space U37. Do not confuse this chip with the OMTI firmware chip which resides near it on the board in space U31. Read and note the model number on the BIOS chip. You need to know this number to accurately set the jumpers on your controller card. Tables are provided later in this section that specify the jumper settings for each different kind of BIOS.

Before UNIX can be installed on a system equipped with an 8620 or 8627 disk controller, you must run your manufacturer's **setup** program and set the computer up for operation without a hard disk. This is because the OMTI firmware supercedes the instructions on

## Release Notes

the normal CMOS systems for hard disks. After you run the setup utility, the installed disk(s) may need to be formatted with the **sfmt** low-level formatting routine, which resides in the OMTI firmware. Low-level disk formatting is usually performed on bundled systems before delivery. If this formatting has not been done, you must format the disk before installing UNIX.

### Standard Installation

UNIX cannot be installed if the disk is in need of low-level formatting or if defective tracks have not been accounted for. Check to see if the system displays a message similar to this when you boot UNIX:

```
%disk 0x320-0x324 36 - type=E unit=0 ...
```

The "E" label indicates that you can use the **sfmt** utility to format your disk, if it is not formatted already. (If you do not see this label, do not use **sfmt** to format your disk.) You are redirected to **sfmt** if you attempt to modify disk parameters through **dkinit** at installation time. You will see:

```
Please use sfmt to modify disk parameters
```

Reboot, then invoke **sfmt** at the "Boot :" prompt to do low-level formatting, non-standard disk parameter initialization, and initial processing of manufacturer-supplied defect lists. If you do not run **sfmt** at this time, you will have to restart your installation procedure and run it before you can successfully install UNIX. **sfmt** should also be used for non-standard disk support.

The defect-processing algorithm reduces the total number of disk cylinders available for use by UNIX. **dkinit** will display the new total.

If the "type=E" banner is not displayed, do not use **sfmt** to format your disk. Instead, please contact your controller's vendor for low-level formatting information if you need to format your disk(s).

Enter **sfmt** at the boot prompt if your disk requires low-level formatting:

## Appendix A

Boot  
: sfmt

You see:

This FORMAT routine will DESTROY ALL data  
on your disk!

Press <RET> to proceed or <ESC> to cancel...

Next you are prompted to enter the number of the drive you are  
formatting. You see:

Enter drive # (0 or 1):

If there is only one hard disk, enter 0. Next you see:

Use default parameters (Y/N)?

If your disk is non-standard, answer N. You must now know the  
parameters for your disk. If you answered N you are prompted to  
enter the total number of cylinders and heads for your disk. You  
see:

Total CYLS:

Total HEADS:

Next you see:

Write Precomp CYL CONTROL BYTE: 2

sfmt supplies "2" as a default but you can overwrite this answer.  
Check your manufacturer's specification for the correct value.

Next you see:

Press <RET> to proceed or <ESC> to cancel...

If you wish to proceed, press RETURN. Next you see:

Logical partitioning desired (Y/N)?

Enter N. Next you see:

Any defects (Y/N)?

## Release Notes

Enter **Y**. You see:

(Press <RET> to end defect list)

CYLINDER:

HEAD:

When you have entered all known defects in the hard disk by cylinder and head numbers, press RETURN at the *CYLINDER* prompt. You see:

More entries (Y/N)?

Enter **N**. Next you see:

Press <RET> to proceed or <ESC> to cancel...

Now you are prompted to set the interleave factor for your hard disk. Disk speed performance may be severely reduced if your interleave factor is set incorrectly. Check your manufacturer's documentation carefully for the correct interleave factor. You see:

Interleave (1-15):

Note that if your disk supports 35 sectors per track, you should not use an interleave value of 5 or 7. Next you see:

Are you SURE you want to format (Y/N)?

Enter **Y** if you are satisfied that all your answers are correct. You see:

Formatting.....

When **sfmt** is finished formatting the disk, you see:

Formatting complete,  
params saved,  
Hit any key to reboot

Press any key and you see the UNIX boot prompt again:

Boot  
:

Press RETURN to begin installation.



### **dkinit**

**dkinit** is primarily for unusual or non-standard disks. Unless you know your disk is non-standard, assume that it is standard. When **dkinit** is run during UNIX installation, choose option 1 to display the current disk parameters. If these parameters do not correspond to the hard disk you have, you must modify the current parameters. If the "disk [E]" banner was displayed at power-up, please use **sfmt** to modify these parameters. Otherwise, follow the instructions provided in the *UNIX Installation Guide*.

### **Badtracking**

The number of cylinders used for bad track alteration will be subtracted from the total number of cylinders available to the user.

After you have finished scanning for badtracks during the installation process, examine the badtrack table. If the "type=E" banner was displayed at power-up and you ran **sfmt**, check to see if any of the flaws in the manufacturer's disk flaw map are displayed in the UNIX badtrack table. If no bad tracks are shown, **sfmt** located all the bad tracks in the flaw map and you do not need to enter them from the list supplied with the disk. If all the bad tracks from the supplied list appear, UNIX **badtrack** located the flaws and you do not need to enter them from the supplied list. If, however, only some of the listed bad tracks are displayed, you must enter any bad tracks that are listed on the supplied bad track list but *not* displayed on the screen. If the "type=E" banner was not displayed, you must enter all of the flaws in the manufacturer's supplied list that are not already displayed in the badtrack table. The following table outlines all possible options and the appropriate actions:

## Release Notes

Display	Action
No bad tracks displayed	Do not enter any bad tracks
All bad tracks displayed	Do not enter any bad tracks
Some bad tracks displayed	Enter any bad tracks not displayed
You did not run <b>sfmt</b>	Enter all bad tracks on the supplied list

Use UNIX badtracking to process defects that need to be added to the bad track table at a later date. Allocate space for future bad tracks even if none are found during the initial scan. Keep in mind that if you do not allocate enough space now, and your table fills up later, you must reinstall to add additional bad tracks.

## Hardware Installation and Initialization

The next few sections are for those system integrators and experienced users who are assembling a computer system from scratch, and who are installing disks themselves.

## DMA/Programmed I/O Considerations

The disk controller supports three different I/O modes: DMA, simple programmed I/O and optimized programmed I/O. DMA is the default mode, simple programmed I/O is slow but will work on virtually all machines, and optimized programmed I/O is fast but may not work on all machines. After you install UNIX, you may switch between the different modes by patching the kernel in single-user mode by applying the following patch:

```
# /etc/_fst -w /unix
* dkio_type /w n
* $q
#
```

The pound signs (#) are prompts from the system shell and the asterisks are prompts from the patch tool; do not type them in.

In the patch above, *n* is 1 for the default DMA mode, 2 for simple programmed I/O mode, and 3 for optimized programmed mode.

The default is programmed I/O. DMA.

Standard personal computers that support I/O channel ready will work with SCO UNIX System V/386 Release 3.2 in the optimized programmed I/O mode with no problems. Machines that do not support I/O channel ready will invariably crash, with a high probability of data corruption. If you are unsure as to whether your machine supports I/O channel ready, consult your computer's manufacturer.

### Interleave Factors

A 1:1 interleave factor is supported. To change interleave factors, refer to the **sfmt** instructions.

### Physical Limitation

The physical limitations for attached disks are 1024 cylinders (10 bits of cylinder addressing) and 16 heads, due to the **fdisk** structure shared by all operating systems. You can attach larger disks, but you cannot use more than 1024 cylinders, even with multiple **fdisk** partitions; the excess storage space is unaddressable.

### Setting Up a One-Drive System

1. Cabling Requirements: One (1) 34-pin straight-through cable. One (1) 20-pin straight-through cable.
2. On the hard disk: Install drive select jumper to lowest Drive Select (DS0 or DS1).
3. On the controller: Install jumpers W20 to W23 according to the information in the "Drive Jumper Settings" table provided in the "Drive Tables" section. To find the correct drive table for your hardware, note your board type and BIOS type and find them on the following table. The BIOS types are listed across the top of the table and the board types are listed down the left side. To find the correct table to use, check the listing at the intersection of your BIOS and board types. For example, If your BIOS type is

## Release Notes

1002579 and your board type is 8620, you can find your correct board settings in Table A.

Board Types	BIOS Types			
	1002579	1002580	1002661	1002662
8620	Table A	‡	Table C	‡
8627	‡	Table B	‡	Table D

‡ indicates a drive/BIOS combination that does not exist.

If your drive is a non-ESDI drive type and it does not correspond to the default ST506 drive type(s), enter disk characteristics as in step 8. Note that if you are adding an ST506 interface disk, jumpers W22 and W23 must be out (0) for any ST506 disk.

4. Remove the existing hard disk controller and unplug the connecting cables. If a separate floppy drive controller is being used, remove it and connect the 34 pin floppy cable to the J1 connector on the ESDI controller.
5. The number of hard disks in the system must be reported as zero (0) when initializing the system configuration parameters using the setup utility provided by your computer's manufacturer.
6. Install the 34-pin drive interface cable to the J2 connector. Install the 20-pin data cable to either the J3 or J4 connector.
7. Install the ESDI controller in any available slot on the motherboard. CAUTION: Power must be off!



## Appendix A

8. Use the manufacturers **setup** utility to change your system settings to indicate that there is no hard disk used with your system.
9. If you need to format your disk, type **sfmt** at the *Boot* : prompt. You must know the hard disk parameters before you invoke **sfmt**.
10. Answer all questions as prompted. Note: If your drive is not listed in the BIOS drive table answer **N** to "*Use defaults (Y/N)?*" prompt. Then, enter the correct drive characteristics. If your drive is a non-ESDI drive type and it does not correspond to the default ST506 drive type(s), you are prompted to enter disk characteristics.
11. At the completion of this installation procedure, you will be directed to reboot the system. After doing so, continue with normal UNIX installation procedure.

### Setting Up a Two-Drive System

1. **Cabling Requirements:** One (1) 34-pin daisy chain straight-through cable. One (1) 20-pin straight-through cable.
2. **On hard disks:** Set *Drive Select* to DS0 (or DS1) on the first drive, and *Drive Select* to DS1 (or DS2) on the second drive. Install termination resistor on drive at end of daisy chain cable. Remove termination resistor on drive in the middle of daisy chain cable.
3. Follow steps 3-9 above.

## Release Notes

### User-Configurable Jumpers

W20	W21	W22	W23	Refer to Drive Tables	
W17	W18	W19	Winchester I/O Port Base Address		
0*	0*	0*	320H		
0	0	1	324H		
0	1	0	328H		
0	1	1	32CH		
1	0	0	1A0H		
1	0	1	1A4H		
1	1	0	1A8H		
1	1	1	1ACH		
W16			BIOS EPROM Control		
0*			Enable BIOS		
1			Disable BIOS		
W15			BIOS Base Address		
0*			C8000H		
1			CA000H		
W14			Floppy Disk I/O Port Base Address		
0*			03F0H		
1			0370H		
W10	W11	Bytes/Sector	Sectors/Track (ST506)		
			8620	8627	
0*	0*	512	17	26	
0	1	512	18		
1	0	1024	9		
1	1	1056	9		

0=Jumper not installed

1=Jumper installed

\*=Jumper as shipped

## Appendix A

LUN 0		LUN 1	
<b>W9</b>	<b>Sector Type</b>	<b>W6</b>	<b>Sector Type</b>
0*	Soft sectored	0*	Soft sectored
1	Hard sectored	1	Hard sectored
<b>W8</b>	<b>Drive Class</b>	<b>W5</b>	<b>Drive Class</b>
0*	ST506 Compatible	0*	ST506 Compatible
1	ESDI Compatible	1	ESDI Compatible
<b>W7</b>	<b>Drive Type</b>	<b>W4</b>	<b>Drive Type</b>
0*	Fixed	0*	Fixed
1	Removable	1	Removable

---

0=Jumper not installed

1=Jumper installed

\*=Jumper as shipped

LUN=Logical Unit Number

### Drive Jumper Settings

**BIOS #1002579, #1002580:**

W20-W23: Hard disk drive jumpers

**BIOS #1002661, #1002662:**

W20           Reserved

W21           I/O Speed Option:

0\*           High Performance (not supported by  
              all computers)

1           Normal

W22, W23     Hard disk drive jumpers

## Release Notes

### Drive Tables

*Table A*  
**8620 Drive Table**  
**BIOS #1002579, AT3**

W20	W21	Drive/Model or Compatibles	Cyl.	Heads	Write Precomp.
LUN 0					
1	1	ESDI Drives			
0	1	Vertex/Priam V170	987	7	-
1	0	Maxtor XT1140	918	15	-
0	0	Miniscribe 3425	612	4	-
W22	W23				
LUN 1					
1	1	ESDI Drives			
0	1	Vertex/Priam V170	987	7	-
1	0	Maxtor XT1140	918	15	-
0	0	Miniscribe 3425	612	4	-

*Table B*  
**8627 Drive Table**  
**BIOS #1002580, BIOS AT4**

W20	W21	Drive/Model or Compatibles	Cyl.	Heads	Write Precomp.
LUN 0					
1	1	ESDI Drives			
0	1	Seagate ST277R	820	6	-
1	0	Seagate ST4144R	1024	9	-
0	0	Seagate ST238	615	4	-
W22	W23				
LUN 1					
1	1	ESDI Drives			
0	1	Seagate ST277R	820	6	-
1	0	Seagate ST4144R	1024	9	-
0	0	Seagate ST238	615	4	-



*Table C*  
**8620 Drive Table \***  
**BIOS #1002661, AT5**

W23	Drive Type	Cyl.	Heads	Write Precomp.
<b>LUN 0</b>				
0	Seagate ST225	612	4	-
1	ESDI Drive			
<b>W22</b>				
<b>LUN 1</b>				
0	Seagate ST225	612	4	-
1	ESDI Drive			

\* If you are adding an ST506 interface disk, jumpers W22 and W23 must be out (0) for any ST506 disk.

*Table D*  
**8627 Drive Table \***  
**BIOS #1002662, BIOS AT6**

W23	Drive Type	Cyl.	Heads	Write Precomp.
<b>LUN 0</b>				
0	Seagate ST238R	615	4	-
1	ESDI Drive			
<b>W22</b>				
<b>LUN 1</b>				
0	Seagate ST238R	615	4	-
1	ESDI Drive			

\* If you are adding an ST506 interface disk, jumpers W22 and W23 must be out (0) for any ST506 disk.

## Release Notes

### Drive Characteristics Reference Guide

#### Drive Characteristics Reference Guide MFM Hard Disk Drives

Drive/Model	Cyl.	Heads	Write Precomp.
Maxtor XT1140	918	15	—
CMI 6426	640	4	256
Rodine 352	306	4	—
Microscience HH312	306	4	—
Seagate ST4026	615	4	300
Cynthia 570	987	7	—
Vertex V170	987	7	—
DMA/RICOH (Removable 10MB)	612	2	400
Seagate ST4038	733	5	300
Seagate ST213	612	2	256
Miniscribe 3425	612	4	128
Quantum Q540	512	8	256
Seagate ST4051	977	5	300
CDC 3212	612	2	128
Miniscribe 3012/3212	612	2	128
CMI 6640	640	6	256
Tulin 240	640	6	256
Seagate ST225	615	4	256
CMI 3426	615	4	256
CMI 5412	306	4	128
Lapine 3522	306	4	128
Otari 514	306	4	128
Seagate ST412/ST212	306	4	128
Shugart 712	306	4	128

**Note:** This is a list of some prominent MFM drives in the industry. It is not a comprehensive list.

## Appendix A

### Drive Characteristics Reference Guide RLL Vendor Certified Hard Disk Drives

Drive/Model	Cyl.	Heads	Write Precomp.
Atasi 3085	1024	8	—
Miniscribe 8438	612	4	—
Microscience HH330	612	4	—
Microscience HH738	612	4	—
Peripheral Tech 357R	615	6	—
Lapine LT300	616	4	—
Priam V170	987	7	—
Priam V185	1024	7	—
Priam 514	1024	11	—
Priam 519	1024	15	—
Seagate ST251R	820	4	—
Seagate ST277R	820	6	—
Seagate ST4077R	1024	5	—
Seagate ST4144R	1024	9	—
Toshiba MK53FB	830	5	—
Toshiba MK54FB	830	7	—
Seagate ST238R	615	4	—
Miniscribe 3438	615	4	—

**Note:** This is a list of some prominent RLL drives in the industry. It is not a comprehensive list.

## Release Notes

### A.6 Microchannel Architecture Hardware Notes

The following sections explain what hardware can be used with 386 machines based on Microchannel Architecture.

#### A.6.1 Math Chips

If your personal computer includes the 80387 math co-processor, the co-processor is automatically detected and supported by the SCO UNIX System V/386 Operating System. This co-processor will improve floating point efficiency.

At boot time, the SCO UNIX System V/386 Operating System announces the presence of a math co-processor with the message:

```
%fpu - 35 - TYPE=80387
```

Please note that switches on the main system board must be set properly to enable 80387 interrupts, or your system must be set up with the manufacturer's setup disk to expect the chip. Ensure that the system diagnostics recognize the co-processor presence and check your hardware manual for the proper switch settings.

SCO UNIX 386 supports the 387 math co-processor.

Some 80387 exceptions have been masked. Refer to the manual page for **8087(HW)**.

#### A.6.2 Serial Cards

The following Serial cards are supported under the SCO UNIX System V/386MC Operating System:

- IBM PS/2 model 3033 dual async 2 port card (up to 3 per system)
- Stargate PLUS 8 MC
- AST 4 port or 8 port Async Cluster Adaptor
- Digiboard PS-COM/8 port or 16 port
- Arnet Multiport/2 port or 8 port - 1 or 2 cards
- Control Hostess/MC 8 port



## Appendix A

### Serial Card Addresses and Notes

Serial Card Addresses			
Physical Port	Board Type	Base Number of ports	Address
COM1	Motherboard	1	0x3F8
COM2	Arnet	16	0x140
	AST	4	0x1A0
	Stargate	8	0x400
	Digiboard	16	0x3000
	Digiboard	8	0xDB80
	HostessMC	4	0x500
	HostessMC	8	0x500
	HostessMC	4	0x540
	HostessMC	8	0x540
	HostessMC	4	0x580
	HostessMC	8	0x580

Dumb boards, on COM 2, such as:

- Hostess
- AST 4 port
- IBM
- Dual Async

occupy addresses as shown below:

## Release Notes

Port Number	Address
1	0x2F8
2	0x3220
3	0x3228
4	0x4220
5	0x4228
6	0x5220
7	0x5228
8	0x2F0

### A.6.3 Video Adapters and Monitors

Microchannel architecture machines have the VGA built into the mother board, therefore, no options are available. Adapters which come as the default adapter in supported computers (monochrome or color monitor) will work with the SCO UNIX System V/386 Operating System.

### A.6.4 Video Cards and Monitors

The following video cards are supported under the SCO UNIX System V/386MC Operating System:

#### IBM

Personal System/2 Integral VGA adapter and the 8503, 8512, 8513, and 8514 monitors

Olivetti P500, Integral VGA

Tandy 5000MC, Integral VGA

Apricot Qi, Integral VGA

### A.6.5 Compatible Hard Disk Controllers

The following controllers are supported for the Microchannel Architecture:

- Adaptec AHA-1640 (SCSI host adapter)
- Adaptec 2610 (ESDI disk controller)
- Adaptec 2620 (ST506 disk controller)
- IBM (ESDI disk controller)
- IBM (ST506 disk controller)
- Western Digital 1006V-MCI (ESDI disk controller)
- Western Digital 1007V-MCI (ST506 disk controller)

### A.6.6 Tape Drive/Controller Combinations

Personal System/2 tape support is being added as Personal System/2 tape devices are just becoming available. Call your software support center for latest tape driver availability.

#### Supported Tape Controllers and Cartridge Drives

Manufacturer	Controller	Drive	Type
Archive	QIC-02	2150L	E
Archive	SCSI	2150S	A
IBM	QIC-02	6157	X
IBM	QIC-02	6157-002	X
Irwin	floppy	245	N/A
Irwin	floppy	285	N/A
Mountain 7060	QIC-02	60MB Filesafe	M
Mountain 7120	QIC-02	150MB Filesafe	M
Tecmar	QIC-02	QT-60E	T
Tecmar	QIC-02	QT-150E	T

## Release Notes

### Default Settings

Manufacturer	Base Address	DMA Channel	Interrupt	Type
IBM 6157	0x3120	2	6	X
Mountain	0x200	1	5	M
Tecmar/Wangtek	0x300	1	3	E
Tecmar/Wangtek	0x300	3	5	T

### A.6.7 SCSI Guidelines

The SCSI bus consists of a 50 conductor flat cable which connects SCSI devices together in a daisy-chained configuration. There are two types of devices that can be hooked onto the SCSI bus: host adapters and controllers. The host adapter is a card that plugs into the computer. Controllers are used to connect different kinds of SCSI devices to the SCSI bus.

The 50 conductor flat cable has a minimum of two connectors and a maximum of eight. This cable can be up to 20 feet long. Care should be taken to ensure that the connectors are plugged into the 50-pin sockets in the correct direction. No electrical damage will result from incorrect orientation, but none of the devices on the bus will work.

The SCSI bus needs electrical termination at both ends of the cable. Host adapters and controllers normally have termination capability built onto their circuit boards. Setting termination on usually involves inserting or removing several resistor-packs from the circuit board, although this can vary from manufacturer to manufacturer. The AHA-1640 is shipped from the factory with termination set on.

If you accidentally terminate a device in the middle of the bus (i.e. not on the end of the cable), the remaining SCSI devices "below" the terminated device will not work. To fix the problem, simply move the termination to the last device on the cable.

The SCO UNIX System V/386MC Operating System supports the following disk controller configurations:



## Appendix A

1. A single ST506 controller (IBM, Adaptec 2610, 2620, Western Digital 1007)
2. A single ESDI controller (IBM, Western Digital 1006)
3. A single SCSI (Adaptec 1640)
4. An ST506 controller plus a SCSI (Adaptec 1640)
5. An ESDI controller plus a SCSI (Adaptec 1640)

The root/boot device is always the first controller whether an ST506, ESDI or SCSI disk controller.

---

### *Note*

When installing an Adaptec 1640 and an ST506, it is advisable to install the ST506 card first, on its own, and then install the Adaptec 1640 card.

---

Each device on the SCSI bus must have an address. The address has two components: an address for the controller and an address for the device itself. The device address is known as a logical unit address (LUN). In this release, the first SCSI disk must be configured as ID-0:LUN-0 (controller address 0, device address 0). The ID number corresponds to the jumper settings on the disk, so care must be taken that hard disk jumpers are set correctly. Additional disks may be any other ID between 1-7. Note that the Host Adapter uses one of the ID numbers (typically number 7). The LUN number must always be 0.

## Release Notes

On a system with both ST506 and SCSI disks, the two supported ST506 disks are hd0 (the boot drive) and hd1. The SCSI disks are hd2, hd3, and hd6 through hd17. If the only disk drives in the system are SCSI, the SCSI drives are hd0 through hd13.

One SCSI tape drive is supported on the SCSI bus. The standard QIC02 cartridge tape controller is also supported, but only one tape drive, either SCSI or QIC02, may be present on the system. The SCSI tape may be configured at any ID on either Host Adapter.

---

### *Note*

150 Mbyte and 120 Mbyte tape drives can generally read 60 Mbyte tapes but not write them.

---

Use **mkdev hd** to add more drives to the system. Use **mkdev tape** to add a tapedrive to the system, SCSI or any other type.

### **A.6.8 Configuration Warning**

It is advisable to configure your machine so that the serial ports, parallel ports and tape drives do not share the same interrupt. Sharing the same interrupt may cause your system to hang.

# **Appendix B**

## **Replacement Manual Pages**

### **Release 3.2.0**

---

B.A Replacement Manual Pages B-1

1. The first part of the paper  
describes the general situation  
of the country.

2. The second part of the paper  
describes the general situation  
of the country.

3. The third part of the paper  
describes the general situation  
of the country.



## **B.A Replacement Manual Pages**

This appendix contains replacement manual pages. Please replace the relevant manual pages in your *Unix User's Reference* with the pages in this appendix.



## ps

---

reports process status

### Syntax

---

*ps* [ options ]

### Description

---

*ps* prints certain information about active processes. Entering *ps* without any options calls up information about processes associated with the current terminal. The following options control the amount and type of information displayed.

### Options

---

- |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -e              | Prints information about all processes.                                                                                                                                                                                                                                                                                                                                                                                                             |
| -d              | Prints information about all processes, except process group leaders.                                                                                                                                                                                                                                                                                                                                                                               |
| -a              | Prints information about all processes, except process group leaders and processes not associated with a terminal.                                                                                                                                                                                                                                                                                                                                  |
| -f              | Generates a <i>full</i> listing. Normally, a short listing containing only process ID, terminal ("tty") identifier, cumulative execution time, and the command name is printed. Under the -f option, <i>ps</i> tries to determine and print the process' original command name and arguments. If it cannot, it prints the short listing version of the command name within square brackets. See below for the meaning of columns in a full listing. |
| -l              | Generates a <i>long</i> listing, including status, priority, location, and memory usage information for each process.                                                                                                                                                                                                                                                                                                                               |
| -t <i>tlist</i> | Restricts listing to data about the processes associated with the terminals given in <i>tlist</i> , where <i>tlist</i> can be in one of two forms: a list of terminal identifiers separated from one another by a comma, or a list of terminal identifiers enclosed in double quotes and separated from one another by a comma and/or one or more spaces.                                                                                           |

- p *plist* Restricts listing to data about processes whose process ID numbers are given in *plist*, where *plist* is in the same format as *tlist*.
- u *ulist* Restricts listing to data about processes whose user ID numbers or login names are given in *ulist*, where *ulist* is in the same format as *tlist*. In the listing, the numerical user ID is printed unless the -f option is used, in which case the login name is printed.
- g *glist* Restricts listing to data about processes whose process groups are given in *glist*, where *glist* is a list of process group leaders and is in the same format as *tlist*.
- s *swapdev* Uses the file *swapdev* in place of /dev/swap. This is useful when examining a core file.
- n *namelist* The argument is taken as the name of an alternate *namelist* (/unix is the default).

## Display Columns

---

The column headings and the meaning of the columns in a *ps* listing are given below; the letters f and l indicate the option (*full* or *long*) that causes the corresponding heading to appear; all means that the heading always appears. Note that these two options only determine what information is provided for a process; they do *not* determine which processes will be listed.

- F (l) A status word consisting of flags associated with the process. Each flag is associated with a bit in the status word. These flags are added to form a single octal number. Process flag bits and their meanings are:
- |    |                                          |
|----|------------------------------------------|
| 01 | in core;                                 |
| 02 | system process;                          |
| 04 | locked in core (e.g., for physical I/O); |
| 10 | being swapped;                           |
| 20 | being traced by another process.         |
- S (l) The state of the process:
- |   |               |
|---|---------------|
| 0 | non-existent; |
| S | sleeping;     |
| R | running;      |
| I | intermediate; |
| Z | terminated;   |
| T | stopped;      |
| B | waiting.      |



PS (C)

PS (C)

UID	(f,l)	The user ID number of the process owner; the login name is printed under the -f option. Login names are truncated after 7 characters.
PID	(all)	The process ID; used when killing a process (see <i>kill(C)</i> ).
PPID	(f,l)	The process ID of the parent process.
C	(f,l)	Processor utilization for scheduling.
STIME	(f)	Starting time of the process.
PRI	(l)	The priority of the process; higher numbers mean lower priority.
NI	(l)	Nice value; used in priority computation.
ADDR1, ADDR2	(l)	The memory addresses (physical page frame numbers) of u-area of the process, if resident; otherwise, the disk address. ADDR1 gives the frame number of the first half of the u-area, and ADDR2 gives the number of the second half.
SZ	(l)	The size in blocks of the core image of the process, but not including the size of text shared with other processes. Since this size includes the current size of the stack, it will vary as the stack size varies.
WCHAN	(l)	The event for which the process is waiting or sleeping; if blank, the process is running.
TTY	(all)	The controlling terminal for the process.
TIME	(all)	The cumulative execution time for the process.
CMD	(all)	The command name; the full command name and its arguments are printed under the -f option.

A process that has exited and has a parent, but has not yet been waited for by the parent, is marked <defunct>.

## Files

---

/unix      system namelist

/dev/mem   memory

/dev      searched to find swap device and terminal ("tty") names.

## See Also

---

*kill(C)*, *nice(C)*

## Notes

---

Things can change while *ps* is running; the picture it gives is only a close approximation to reality.

Some data printed for defunct processes are irrelevant.

## Authorization

---

The behavior of this utility is affected by assignment of the mem authorization, which is usually reserved for system administrators. If you do not have this authorization, the output will be restricted to data pertaining to your activities only. Refer to the "Using a Trusted System" chapter of the *User's Guide* for more details.

## Standards Conformance

---

*ps* is conformant with:

AT&T SVID Issue 2, Select Code 307-127;  
and The X/Open Portability Guide II of January 1987.



8-7-89  
018-030-902